Background Report

City of Lincoln
General Plan






October 2020

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General Plan Background Report

8.1 Introduction

The City of Lincoln is responsible for helping to protect community members from danger and harm. The Health & Safety Element conveys the City's goals, policies, and actions to minimize the hazards to public health and safety in and around Lincoln. It identifies the natural and human-caused hazards that affect existing and future development and provides guidelines for protecting residents, employees, visitors, and other community members from injury and death. It describes present conditions and sets policies and standards for improved public safety. The Health & Safety Element also seeks to minimize physical harm to the buildings and infrastructure in and around Lincoln and to reduce damage to local economic systems, community services, and ecosystems.

Some degree of risk is inevitable—the potential for many disasters cannot be completely eliminated, and the ability to predict such disasters is limited. The goal of the Health & Safety Element is to reduce the risk of injury, death, property loss, and other hardships to acceptable levels. In accordance with California law, the Health & Safety Element serves the following purposes:

- Protect the community from risks associated with a variety of hazards, including seismic activity, landslides, flooding, and wildfire, as required by the California Government Code Section 65302(g)(1).
- Map and assess the risk associated with flood hazards, develop policies to minimize the flood risk to new development and essential public facilities, and establish effective working relationships among agencies with flood protection responsibilities, as required by California Government Code Section 65302(g)(2).
- Map and assess the risk associated with wildfire hazards, develop policies to reduce the wildfire risk to new land uses and essential facilities, ensure there is adequate road and water infrastructure to respond to wildfire emergencies, and establish cooperative relationships with wildfire protection agencies, as required by California Government Code Section 65302(g)(3).
- Assess the risks associated with climate change on local assets, populations, and resources. Note existing and planned development in at-risk areas and identify agencies responsible for providing public health and safety and environmental protection. Develop goals, policies, and objectives to reduce the risks associated with climate change impacts, including locating new public facilities outside of at-risk areas, providing adequate infrastructure in at-risk areas, and supporting natural infrastructure for climate adaptation, as required by California Government Code Section 65302(g)(4).

8.2 Existing Conditions

This section outlines the existing hazardous conditions and other public safety issues in Lincoln, including geologic and seismic hazards, air quality, human-made hazards, flooding, and fire (urban and wildland). It provides details pertaining to probable locations where each hazard or issue is likely (per availability of data), past notable events in and around Lincoln, agencies responsible for providing protection from these public safety issues, and other background information required by the state.

8.2.1 Geologic and Seismic Hazards

Geologic and seismic hazards are caused by the movement of different parts of the Earth's crust, or surface. Seismic hazards are associated with potential earthquakes in a particular area. Geologic hazards are large-scale, complex natural events that happen on land and are capable of inflicting harm to people or property.

Seismic Hazards

The City of Lincoln is in a seismically active region, and there is a high potential that the area will be subject to at least moderate earthquakes one or more times over the next century. Seismic activity causes pressure to build up along a fault, and the release of pressure results in ground shaking. This shaking itself is known as an earthquake. Earthquakes can also trigger other hazards, including surface rupture (cracks in the ground surface), liquefaction (causing loose soil to lose its strength), landslides, and subsidence (sinking of the ground surface).

Both active and potentially active faults pose risks to Lincoln. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected, and potentially active faults have shown displacement within the last 1.6 million years and may or may not create future earthquakes.

- Structures most likely to be affected are those that are old or near earthquake faults, such as the Bear Mountain Fault and Melones Fault. These faults are approximately 20 and 27 miles east from Lincoln, respectively. These faults would have the greatest potential for damaging buildings in Lincoln, especially the unreinforced masonry structures in the older part of the city and structures built before 1960 without adequate anchorage of framing and foundations. Active faults between zero and 50 miles from Lincoln include the Dunnigan Hills Fault and Cleveland Hills Fault.
- Active faults located between 50 and 100 miles from Lincoln include the West Napa Fault, Marsh Creek Fault, Concord-Green Fault, Hayward Fault, and Calaveras Fault. With all these active faults, there is a high potential that the area will be subject to at least moderate ground shaking one or more times over the next century.

Additionally, Lincoln may experience minor ground shaking from distant earthquakes on faults to the west and east. For example, to the west, both the San Andreas Fault (source of the 8.0-estimated Richter magnitude San Francisco earthquake that damaged Sacramento in 1906) and the closer

Hayward Fault have the potential for major events. The San Andreas Fault near San Francisco and the Hayward Fault in the East Bay area are 105 and 85 miles, respectively, from Lincoln. Similarly, several faults in Nevada may cause minor ground shaking in Lincoln. Critical damage may also occur to structures that provide emergency services (hospitals, fire stations, schools, emergency shelters). Roads and utility lines for water, gas, power, telephone, sewer, and storm drainage may be disjointed and services cut off. These structures require special attention in the public safety programs of the city.

Figure 1 shows the fault lines in and around Lincoln.

Geologic Hazards

Geologic hazards, such as landslides, depend on the geologic composition of the area. The City's Planning Area is characterized by gently rolling hills and level terraces, ranging in elevation from 80 to 150 feet above sea level, sloping to the west-northwest and west toward the Feather and Sacramento Rivers. Prominent topographic features in the Planning Area include the Auburn Ravine, Markham Ravine, and Ingram Slough. The Planning Area is underlain by unconsolidated older alluvium of Pleistocene and Holocene age. Pliocene to Pleistocene deposits of continentally derived sand, silt, clays, and poorly sorted gravel underlie these older alluvial deposits. The young alluvial deposits are up to 100 feet thick and are found primarily along Orchard Creek. The older alluvium underlies the majority of the western and central portions of the Planning Area, consists of mainly unconsolidated alluvium extending several hundreds of feet in depth, and is considered a well-developed water-bearing unit.

Geologic hazards in Lincoln include small slumps. The Planning Area is relatively level, and therefore landslide events in the immediate area consist primarily of minor slumping along riverbanks, levees, and dikes and in the shallow gorges of the various waterways that traverse the Planning Area. Lands around major fault zones are exposed to greater geologic hazards as a result of repeated fault movement. Areas with the greatest potential for liquefaction are those where the water table is less than 20 feet below ground surface and the soils are predominantly clean and relatively uniform low-density sands. The probability of soil liquefaction in the Planning Area is considered a low hazard due to the substantial distance from the active Hayward and Concord fault zones and the type of ground shaking expected from those faults. Highly expansive soils can cause structural damage to foundations and roads. Lawn watering could concentrate subsurface water and subsequent soil expansion could cause land slippage.

Figure 2 shows the landslide susceptibility zones in and around Lincoln.

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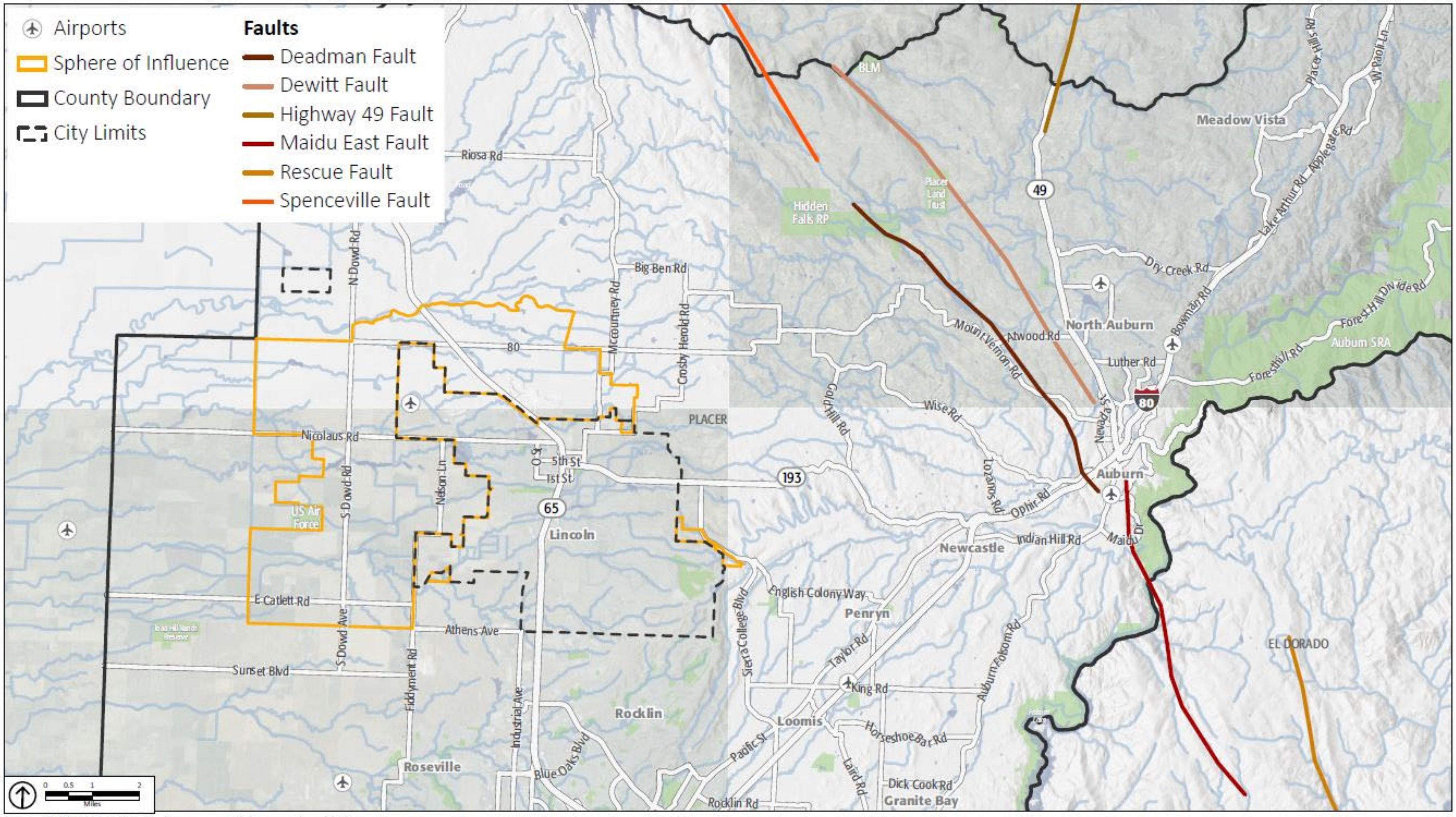
CITY OF LINCOLN SAFETY ELEMENT UPDATE
CITY OF LINCOLN
SAFETY ELEMENT



Source: ESRI, 2020; California Department of Conservation, 2019.

Figure 1
Faults

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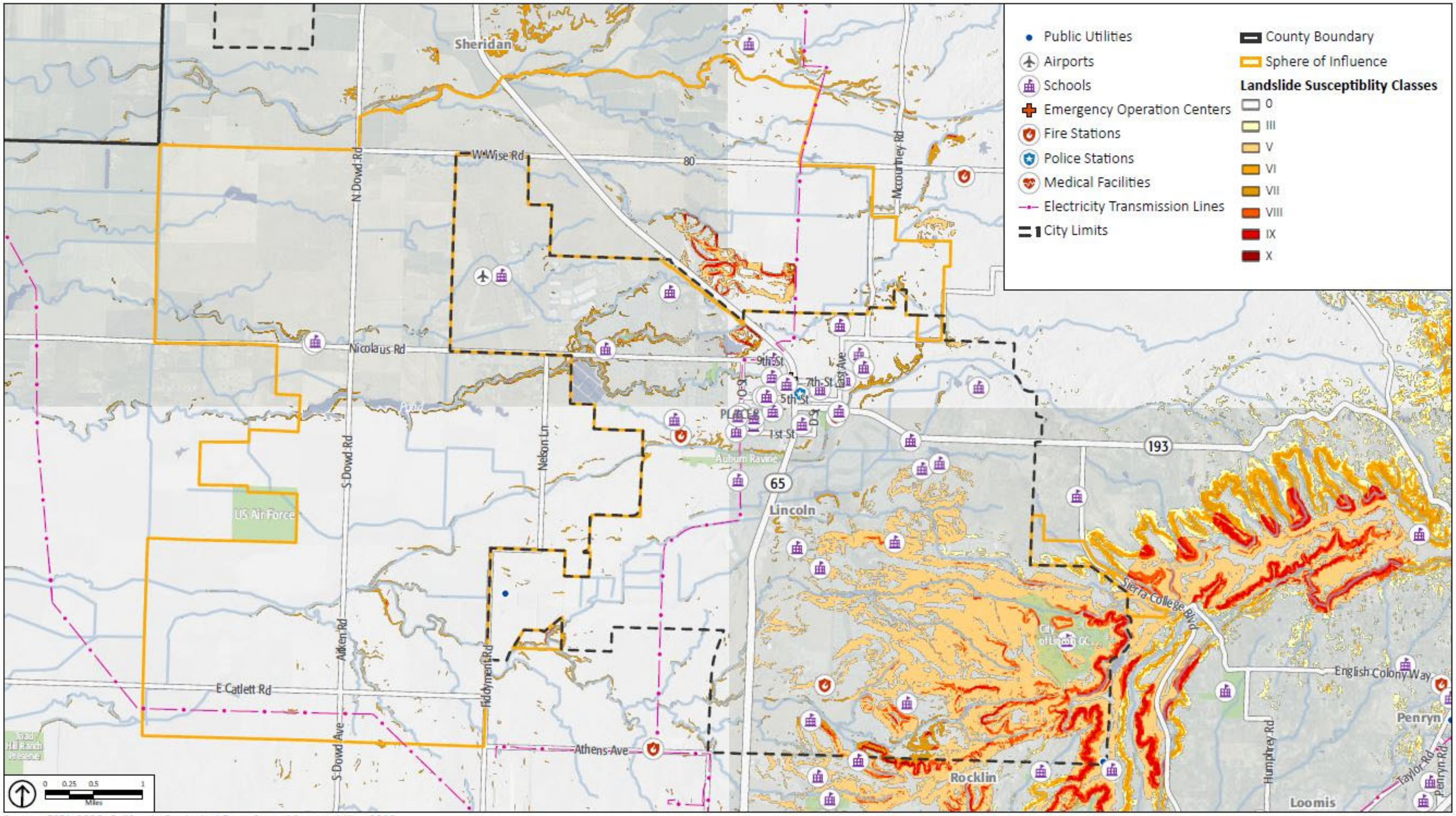
CITY OF LINCOLN SAFETY ELEMENT UPDATE
CITY OF LINCOLN
SAFETY ELEMENT



Source: ESRI, 2020; California Geological Deep Seated Susceptibility, 2019.

Figure 2
Landslide Susceptibility

Potential Changes to Geologic and Seismic Risk in Future Years

Likelihood of Future Occurrence

Geologic Risk

Likely—Minor landslides have occurred in the past, probably over the last several hundred years, evidenced by both past deposits exposed in erosion gullies and recent landslide events. With significant rainfall, additional failures are likely in the identified landslide hazard areas, minor landslides will likely continue to impact the area when heavy precipitation occurs, as they have in the past. In addition, areas affected by recent fires show an increased landslide risk.

Seismic Risk

Unlikely—Placer County is traversed by a series of northwest-trending-faults that are related to the Sierra Nevada uplift. Several active faults are in the vicinity of Placer County and Lincoln. The Cleveland Hills Fault is the closest active fault to the city, located over 40 miles north. The nearest mapped fault trace to the city is the Willow Fault. The northwest-southeast-trending, pre-Quaternary, Willows fault zone is approximately 15 miles southwest of Lincoln. As noted above, the Bear Mountain and Melones Faults are also relatively close to Lincoln. However, these three nearer faults are considered inactive and unlikely to cause seismic activity.

Throughout recorded history, no major earthquakes have been recorded in Lincoln. Earthquakes on various active and potentially active San Francisco Bay Area fault systems could produce a wide range of ground-shaking intensities in the vicinity, but the impacts to the city would be less severe than closer to the source. The greatest ground shaking in the immediate area occurred on April 21, 1892. The epicenter was between Winters and Vacaville in Yolo County. No fatalities occurred in the city, and only minor structural damages resulted from the earthquake.

Climate Change and Geologic and Seismic Hazards

Though climate change is unlikely to increase earthquake frequency or strength, it may result in precipitation extremes (i.e., wetter wet periods and drier dry periods). Total average annual rainfall may decrease only slightly, but is predicted to occur in fewer, more intense precipitation events. Heavy rainfall or snowfall could cause an increase in the number of landslides or make landslides larger than normal. The combination of a generally drier climate in the future, which will increase the chance of drought and wildfires, and the occasional extreme downpour is likely to cause more mudslides and landslides.

8.2.2 Air Quality

Air quality in a given location is described as the concentration of various pollutants in the atmosphere, generally expressed in units of parts per million (ppm) or in micrograms per cubic meter (ug/m^3). The type and amount of regulated air pollutants emitted into the atmosphere, the size and topography of the regional air basin, and the prevailing meteorological conditions, determine air quality.

Emission sources are divided into two main categories: stationary and mobile.

- Stationary sources are fixed in place, such as industrial buildings, burning crop residuals, and exposed soils/minerals (source of dust). In the city, the main stationary-source pollutants are ozone precursors associated with the use of cleaning and surface coatings and from local industrial processes. Other stationary sources include PM_{10} emissions associated with road dust, burning, construction and demolition activities, and fuel combustion (at stationary locations, such as industry or residences). Natural sources of PM_{10} emissions include wildfires.
- The primary source of mobile emissions is vehicles (automobiles, passenger trucks, trucks, and buses). Vehicle emissions are also the primary source of ozone precursors. To measure air quality conditions, several monitoring locations have been established in and around the city.

With the continuing growth in population, air quality has become an issue of increasing concern for the Sacramento Valley Air Basin, in which the city is located. The Planning Area is in southwestern Placer County at the southern end of the Sacramento Valley. The Sacramento Valley is bounded by the Coast and Diablo Ranges on the west and by the Sierra Nevada on the east. Southwestern Placer County is about 75 miles northeast of the Carquinez Strait, a sea-level gap between the Coast Ranges and the Diablo Ranges where the intervening terrain is flat. For the most part, the Planning Area is on flat terrain.

The region experiences temperature inversions, which limit atmospheric mixing and trap pollutants, resulting in high pollutant concentrations near ground level. A temperature inversion, also known as a thermal inversion, is a thin layer of the atmosphere where the normal decrease in temperature with height switches to an increase in temperature with height. Surface inversions (0 to 500 feet) are most frequent during winter; subsidence inversions (1,000 to 2,000 feet) are most frequent during summer. Generally, the lower the inversion base height and the greater the temperature increase from the base to the top, the more the inversion will inhibit dispersion.

The significance of a given pollutant's concentration is determined by comparison with federal and state ambient air quality standards established by the federal and state Clean Air Acts as well as with other state and regional air protection regulations and programs. Both the State of California and the federal government have established ambient air quality standards for several different pollutants, expressed as maximum allowable concentrations. For some pollutants, separate standards have been set for different periods of time. Most standards have been set to protect public health, although for some pollutants, standards have been based on other values (such as protection of crops, protection of materials, or avoidance of nuisance conditions).

Dust and other particulates come in a range of particle sizes. Federal and state air quality regulations reflect the fact that smaller particles are easier to inhale and can be more damaging to health. Very small particles of certain substances may produce injury by themselves in the respiratory tract or may contain absorbed gases that are injurious. Suspended in the air, particulates of aerosol size can both scatter and absorb sunlight, producing haze and reducing visibility. They can also cause a wide range of damage to several types of materials.

PM_{10}. Dust/particulates that are 10 microns in diameter or smaller. PM_{10} monitoring data for the period of 2014 to 2018 is summarized in **Table 1**. The nearest monitoring stations for PM_{10} is in Roseville. As shown in the table, the State 24-hour PM_{10} standard was exceeded at this location in 2015, 2017, and 2018.

Ozone. Ozone is a pungent, colorless toxic gas created in the atmosphere rather than emitted directly into the air. Ozone is produced in complex atmospheric reactions involving oxides of nitrogen and reactive organic gases with ultraviolet energy from the sun. Ozone is the main ingredient of smog. Ground-level ozone is formed from the reaction of oxygen-containing compounds with other air pollutants in the presence of sunlight. Ozone is among the most widespread and significant air pollution health threats in California. As an oxidant, it can damage vegetation and other materials, such as untreated rubber. Ozone can also cause lung irritation, inflammation, and worsening of existing chronic health conditions, even at low levels of exposure. Motor vehicles are the major sources of ozone precursors.

Ozone monitoring is currently conducted at the Lincoln, Roseville, and Auburn stations. As shown in the table, the State ozone standard has been exceeded from one to twelve days at the Auburn station, zero to three days at the Lincoln stations, and one to five days at the Roseville station.

Sensitive Receptors in the City

Sensitive receptors are typically defined as populations or uses that are more susceptible to the effects of air pollution than the general population. Sensitive receptors in Lincoln include the following populations or uses:

- Long-term healthcare facilities
- Rehabilitation centers
- Convalescent centers
- Retirement homes
- Residences
- Schools
- Playgrounds
- Childcare centers
- Athletic facilities

Table 1. Summary of PM_{10} and Ozone Air Quality Monitoring Data, 2014 to 2018

Pollutant/ Monitoring Station	Parameter	Year					
		California Standard	2014	2015	2016	2017	2018
PM10 (ug/m3)							
Roseville (N. Sunrise Blvd)	Annual arithmetic mean	20 ug/m3	18	N/A	N/A	N/A	N/A
	24-hour maximum	50 ug/m3	31.8	59.1	39.1	65.8	211.3
Ozone (ppm)							
Auburn (11645 Atwood Road)	1-hour maximum	0.09 ppm	0.097	0.109	0.114	0.111	0.135
	Days above state standard[a]		1	4	5	3	12
Lincoln (1445 1st Street)	1-hour maximum	0.09 ppm	0.107	0.098	0.102	0.099	N/A
	Days above state standard[a]		1	2	3	1	N/A
Lincoln (2885 Moore Road)	1-hour maximum	0.09 ppm	N/A	N/A	N/A	N/A	0.07
	Days above state standard[a]		N/A	N/A	N/A	N/A	0
Roseville (N. Sunrise Blvd.)	1-hour maximum	0.09 ppm	0.097	0.098	0.115	0.117	0.11
	Days above state standard[a]		4	1	5	4	4

Source: California Air Resource Board 2020.

Notes: N/A = Not available or insufficient data available to determine value.

[a] *Days above standard means days with one or more exceedance of the 1-hour ozone standards*

8.2.3 Human-Made Hazards

The primary human-made hazard concerns for the city are hazards associated with crime and hazardous materials.

Crime

Crime and other acts of violence undermine the community's sense of security and threaten public safety. As Lincoln develops, criminal activities could increase with the population, although the crime rate (number of crimes per 1,000 population) would not necessarily increase. While it is expected that individuals will take normal precautions to protect themselves from danger, the City provides additional protection. The Lincoln Police Department plays a significant role in maintaining safety and quality of life in the community. Some of the police department's crime prevention programs are: Chaplaincy, Megan's Law, National Night Out, and Neighborhood Watch.

Hazardous Materials

Hazardous materials pose a significant risk to public safety or human or environmental health. They include toxic chemicals, flammable or corrosive materials, petroleum products, and unstable or dangerously reactive materials. They can be released through human error, malfunctioning or broken equipment, or as an indirect consequence of other emergencies (e.g., if a flood damages a hazardous material storage tank). Hazardous materials can also be released accidentally during transportation, as a consequence of vehicle accidents. Numerous human-made substances can be hazardous to health. Hazardous wastes generated by city residents and businesses contribute to environmental and human health hazards.

8.2.4 Flooding

Flooding is the rising and overflowing of a body of water onto normally dry land. The data on the flood risk in Lincoln, including information on parcels in flood-prone areas and their improved value, are taken from the Placer County Local Hazard Mitigation Plan (LHMP). The LHMP analyzes the risk in flood-prone areas as reported by the Federal Emergency Management Agency (FEMA) in the most recent available flood plain mapping. The City is actively working with the Placer County Flood Control and Water Conservation District to regularly assess the risk of flooding in the community and to reduce the threat it poses to Lincoln community members and property. Most parcels in Lincoln's flood-prone areas are not used for residential purposes.

History highlights floods as one of the most frequent natural hazards impacting communities in Placer County. They are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. They can be extremely dangerous, and even six inches of fast-moving water can knock over a person. Floodwaters can transport large objects downstream, which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed in sediment deposits. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, building foundations, and electrical circuits.

Runoff from the Lincoln Planning Area is drained by the Auburn Ravine, Markham Ravine, and Orchard Creek stream courses and enters the Sacramento River near its confluence with the Feather River in Sutter County. There is also a separate drainage course that drains the Lincoln airport. The area near the confluence includes large areas of slough and floodplain, which absorb excess flows from the above watersheds during heavy rains and spring floods. Much of the stormwater of this floodplain area is maintained through a complex system of levees and dikes.

Lincoln experiences two types of flooding. The first is associated with the Markham and Auburn Ravines and their tributaries. Flooding within Markham Ravine is known to occur mostly in the rural areas of the city, where culvert and bridge crossings do not provide adequate capacity. Similarly, the City has recorded several flooding events along the Auburn Ravine corridor and its tributaries due to inadequate capacity at culvert and bridge crossings. The second is localized in nature and due to inadequate surface flow. Limited curbs and gutters in parts of the city, along with storm drains that may not have sufficient capacity to deal with some storm events, can result in standing water that is both a nuisance and a potential hazard. Heavy rainfall periods can result in both types of flooding.

General rainy season floods can occur in Lincoln any time from November through April. This type of flood results from prolonged, heavy rainfall and is characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when prior rainfall has resulted in saturated ground conditions. This is due to the clayey nature of the soils as well as the prevalence of a hardscaped subsurface throughout most of the Lincoln area, which can result in some areas of standing water and localized flooding. Other localized flooding hazards are caused by obstacles to natural drainage flows, such as the railroad and highway bridges along SR 65 at the Auburn Ravine. During periods of high runoff, these structures tend to act as barriers, causing water to back up east of the highway into natural depressions and south between the railroad tracks and SR 65.

Areas at an elevated risk of flooding are generally divided into 100-year flood zones and 500-year flood zones. A 100-year flood zone has a 1 percent chance of experiencing a major flood in any given year; a 500-year flood zone has a 0.2 percent chance of flooding in any given year. As identified in **Figure 3**, the city is inside of the 100 and 500-year flood zones.

As land uses and climate conditions shift and as improvements are made to flood control channels, the size of these flood zones is likely to change. **Table 2** contains flood analysis results for Lincoln, as reported by the Placer County LHMP. This table shows the number of parcels in the 100- and 500-year flood zones. Improved parcels include land that was developed for some use by the construction of buildings or infrastructure, or land that has been prepared for development by grading, draining, or installing utilities.

Table 2. Lincoln Planning Area: Count and Improved Value of Parcels in Flood Zone

100-Year Flood Zone			500-Year Flood Zone		
Total Parcel Count	Improved Parcels	Total Improved Value	Total Parcel Count	Improved Parcels	Total Improved Value
114	19	$14,766,193	54	49	$6,595,122

Source: Placer County 2016 LHMP.

Note: With respect to improved parcels within the floodplain, the actual structures on the parcels may not be within the actual floodplain, may be elevated, or may be otherwise outside of the identified flood zone.

Table 3 represents a summary analysis of total acres for each Federal Emergency Management Act Digital Flood Insurance Rate Map flood zone for the planning area, as reported by the Placer County LHMP.

Table 3. Lincoln Planning Area: Flooded Acres

Flood Zone	Total Flooded Acres	Improved Flooded Acres	% of Improved Flooded Acres
100-Year Flood Zone	1,192.63	188.32	15.8%
500-Year Flood Zone	14.70	11.37	77.4%

Source: Placer County 2016 LHMP.

Note: With respect to improved parcels within the floodplain, the actual structures on the parcels may not be within the actual floodplain, may be elevated, or may be otherwise outside of the identified flood zone.

Table 4 represents a summary analysis of total acres for each Federal Emergency Management Act Digital Flood Insurance Rate Map flood zone for the planning area. This analysis was originally prepared for the Placer County LHMP.

Table 4. Lincoln Planning Area: Flooded Acres

Flood Zone	Total Flooded Acres	Improved Flooded Acres	% of Improved Flooded Acres

100-Year Flood Zone	1,192.63	188.32	15.8%
500-Year Flood Zone	14.70	11.37	77.4%

Source: Placer County 2016 LHMP.

Most of the land in Lincoln within a mapped flood plain is not used for residential purposes. While this does not minimize the potential damage from flooding, it does mean that fewer people live in a mapped flood plain and so fewer people are likely to be directly harmed. According to a land use analysis, an estimated 42 people live in the 100-year flood zone, and zero in the 500-year flood zone (see **Table 5**), as originally reported in the Placer County LHMP.

Table 5. Lincoln Planning Area: Population at Risk of Flooding

100-Year Flood Zone		500-Year Flood Zone	
Improved Residential Parcels*	Population**	Improved Residential Parcels	Population
16	41	0	0

Source: Placer County 2016 LHMP.

**The actual structures on the parcels may not be located within the actual floodplain, may be elevated, or may be otherwise outside of the identified flood zone.*

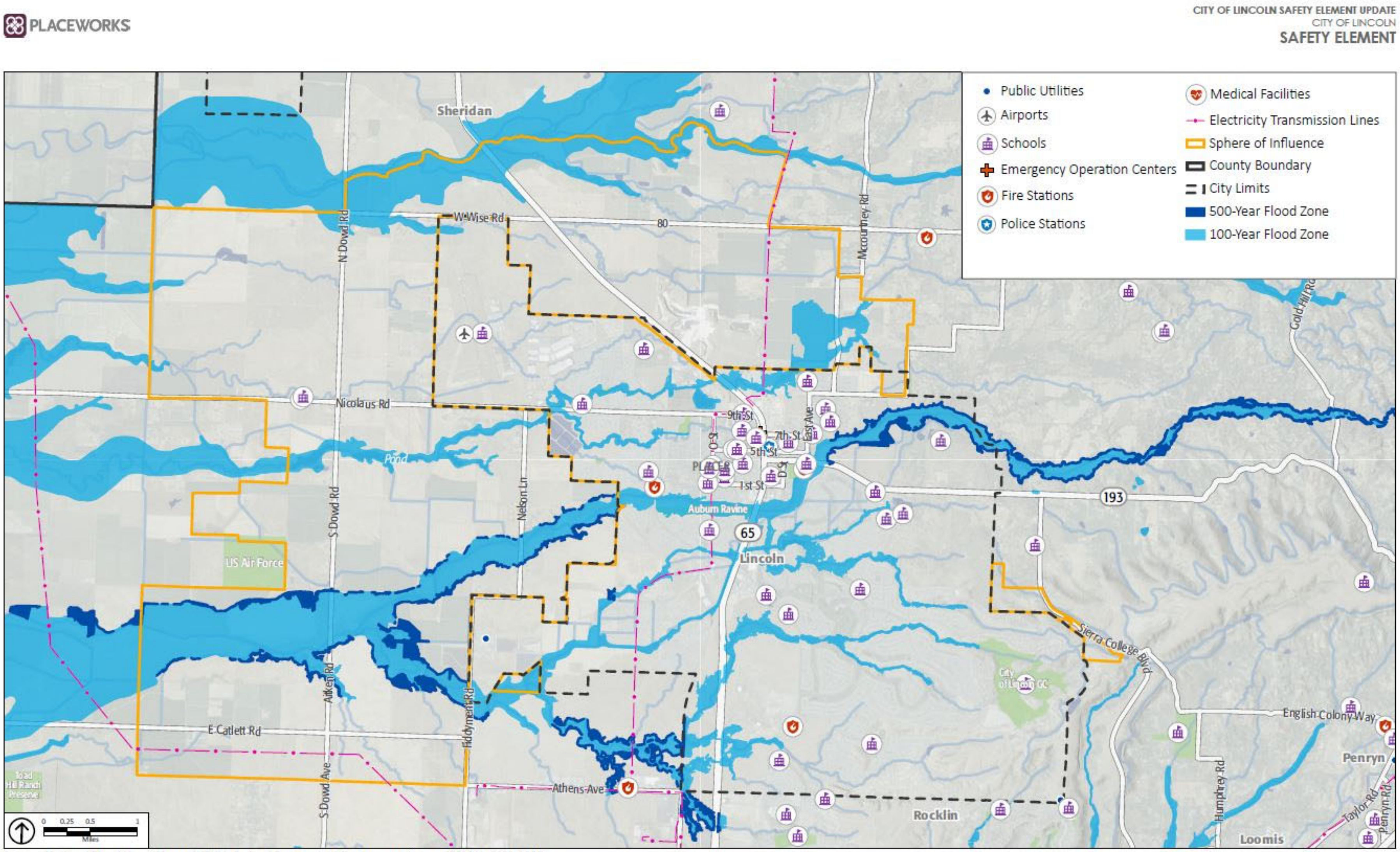
***2010 Census. The 2010 average household size for Lincoln is 2.59.*

Both earthquake faults and developments reduce the total ground absorption area. Earthquake faults include bedrock features that create barriers to subsurface percolation, thus increasing the velocity and erosive capacity of stormwater runoff on hillsides. Development also creates impermeable surfaces (structures, pavement, streets). Storm runoff is augmented by water flows from development contributing to street flooding. Moreover, developed areas generate irrigation water runoff from landscaping, which may channel stormwater and other runoff flows into nearby underdeveloped areas and street gutters.

Potential Changes to Flood Risk in Future Years

Likelihood of Future Occurrence

Occasional—Lincoln is traversed by several stream systems that collect and convey storm runoff west toward the Cross Canal collection system, ultimately discharging into the Sacramento River near its confluence with the Feather River in Sutter County. The primary stream systems in the city include: Auburn Ravine (including Orchard Creek and Ingram Slough tributaries); Markham Ravine (including Clay Creek and Markham Ravine South, and Markham Ravine Central tributaries); and Coon Creek.



Source: National Flood Hazard Layer (NFHL), Federal Emergency Management Agency (FEMA); ESRI, 2020.

Figure 3
Flood Hazard

Climate Change and Flooding

Floods are among the most damaging natural hazards in Placer County, and climate change is expected to make them worse, including in and around Lincoln. Although climate change may not change average precipitation levels very much, scientists expect that it will cause more years with extreme precipitation events. This means that more years are likely to see particularly intense storm systems that drop enough precipitation over a short enough period to cause flooding. Because of this, floods are expected to occur more often in Placer County, and climate change may expand the parts of Placer County that are considered flood prone. There are some indirect effects of climate change that may also increase flooding throughout Placer County. Climate change is expected to increase the frequency and severity of droughts, which cause soil to dry out and become hard. When precipitation does return, water runs off the surface rather than being absorbed into the ground, which can lead to floods. Wildfires, which are also expected to become more frequent due to climate change, cause a similar effect by baking the surface of the ground into a harder and less penetrable layer. Trees and other vegetation help slow water down, which lets the water absorb into the soil and prevents it from turning into runoff. Because of this, the loss of trees and other plants from wildfires, pests, diseases, or other climate-related exposures can also increase flooding risk.

8.2.5 Fire

Fire hazards can take the form of wildfires or urban fires. California is recognized as one of the most fire-prone and consequently fire-adapted landscapes in the world. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural ignition sources, has created conditions for extensive wildfires. Wildfire is an ongoing concern for communities in Placer County. The wildfire season in the Sierra foothills typically lasts mid-June through early-October, although drought years or unusual weather may extend the period. Fire conditions arise from a combination of high temperatures, low moisture content in the air and fuel, an accumulation of vegetation, and high winds.

Three types of fires are of concern to the City: (1) wildfires, (2) wildland-urban interface fires, and to a lesser extent (3) structural fires.

Wildfires

Wildfires occur on mountains, hillsides, and grasslands. Vegetation, wind, temperature, humidity, and slope are all factors that affect how these fires spread. In the Planning Area, native vegetation, such as chaparral, sage, and grassland provide fuel that allows fire to spread easily across large tracts of land. These plant species are capable of regeneration after a fire, and periodic wildfires are a natural part of the ecology of these areas. The climate of the Lincoln region keeps the grass dry and more readily combustible during fire season. In addition, there is a great potential for wildfires in the more open hillside areas in the eastern part of the Planning Area.

Wildland-Urban Interface Fires

The wildland-urban interface is an area where human structures and infrastructure (e.g., homes, community facilities, water and wastewater structures) mix with areas of flammable wildland vegetation. The wildland-urban interface is divided into the defense zone (areas in close proximity to communities, usually about a quarter-mile thick) and threat zones (a buffer zone approximately one and a quarter-mile-thick around the defense zone). Wildfires and wildland-urban interface fires have occurred close to or encroached into the city, especially in the heavily fueled areas. In the wildland-urban interface, efforts to prevent ignitions and limit wildfire losses hinge on hardening structures and creating defensible space through a multifaceted approach, which includes engineering, enforcement, education, emergency response, and economic incentive. There are different strategies in both the defense and threat zones of the wildland-urban interface that can help limit the threat of fire and reduce the risk to people and property.

Wildfire threat in the city is classified into fire hazard severity zones—urban unzoned, non-wildland/non-urban, moderate, high, and very high. **Figure 4** shows the wildfire hazard severity zones in and around Lincoln. The highest threat occurs along the eastern edge of the city, in land that is generally undeveloped.

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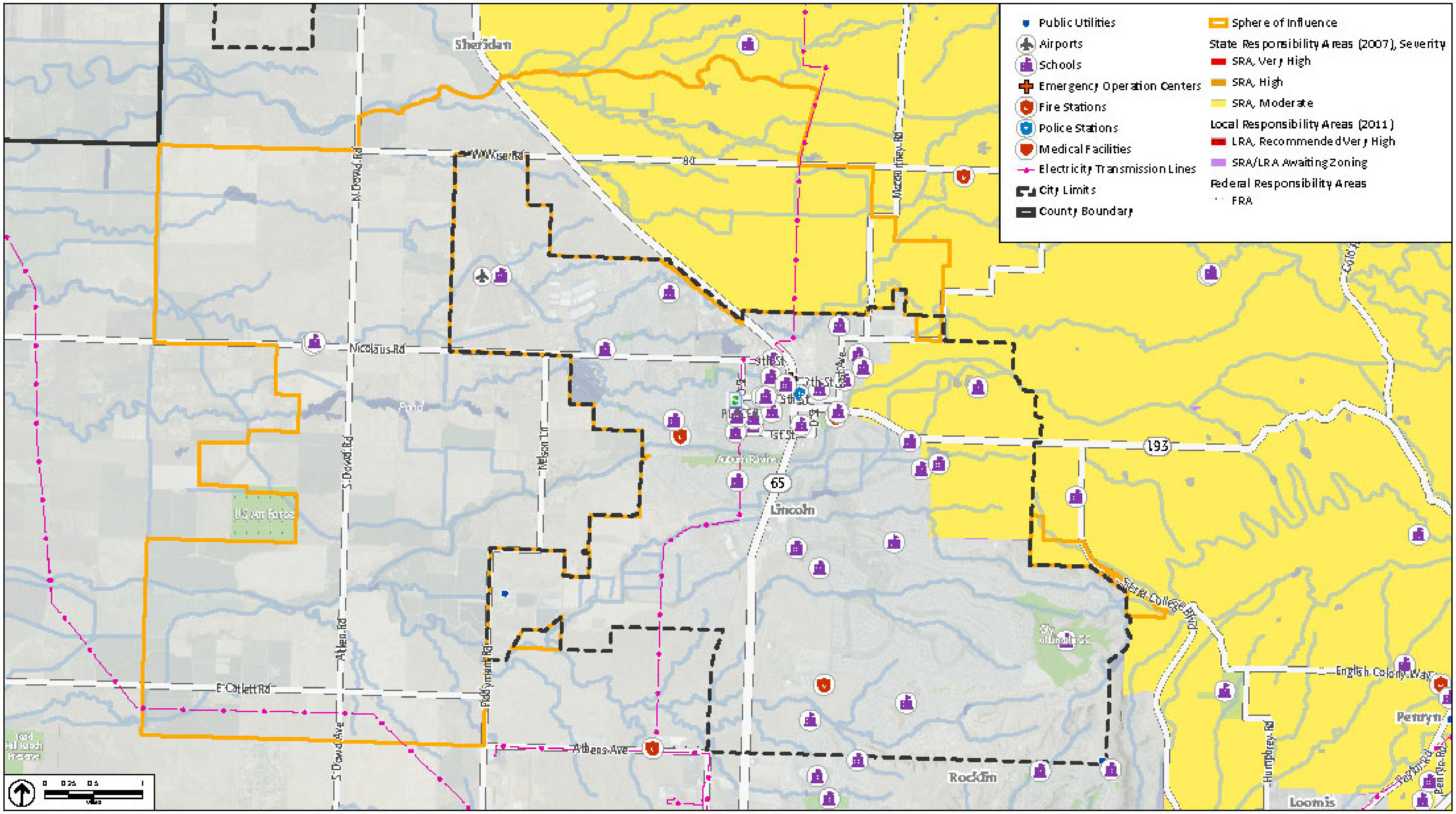


Source: California Department of Forestry and Fire Protection (CALFIRE); ESRI, 2020.

Figure 4
CALFIRE Hazard Severity Zones and Responsibility Areas

Structural Fires

Urban fires occur in built-up environments, destroying buildings and other structures. These disasters are often due to faulty wiring or mechanical equipment, combustible construction materials, or the absence of fire alarms and sprinkler systems. Structural fires have been due largely to human accidents, although arson is the cause of some events. Older buildings that lack modern fire safety features may face greater risk of damage from fires. To minimize fire damage and loss, the City's Fire Code, based on the State Fire Code, sets standards for building and construction. It requires the provision of adequate water supply for firefighting, fire retardant construction, and minimum street widths, among other things. Fire prevention awareness programs and fire drills are conducted to train residents to respond quickly and correctly to reduce injury and losses during fires.

Analysis results for the Lincoln Planning Area are summarized in **Table 6**, including total parcel counts, improved parcel counts, and their improved and land values by property use, as well as the percentage of parcels affected by each fire severity zone.

Table 6. Count and Value of Parcels by Fire Severity Zone

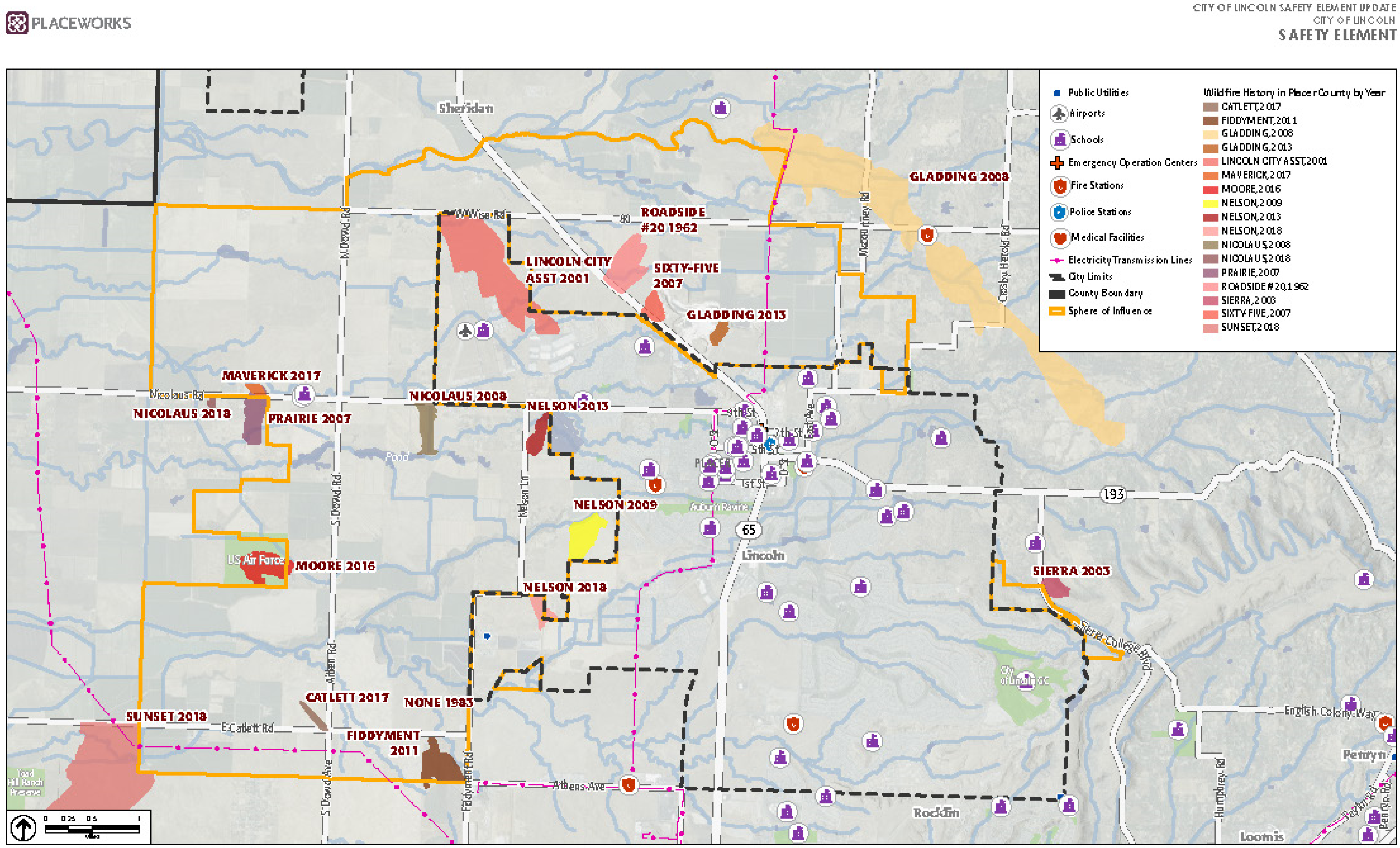
Very High Fire Severity				
Total Parcel Count	**Total Land Value**	**Improved Parcel Count**	**Improved Structure Value**	**Total Value***
0	$0	0	$0	$0
High Fire Severity				
0	$0	0	$0	$0
Moderate Fire Severity				
0	$0	0	$0	$0
Urban Unzoned Fire Severity				
10,531	$877,558,291	10,500	$2,465,693,833	$3,343,252,124
Non-wildland/Non-urban Fire Severity				
773	$71,770,716	587	$138,612,148	$210,382,864
None Assigned				
0	$0	0	$0	$0
Total				
11,304	**$949,329,007**	**11,087**	**$2,604,305,981**	**$3,553,634,988**

Source: Placer County 2016 LHMP.

*Note: *Land and structure values.*

Past Wildfires

Several wildfires have occurred near the city. Notably, in 2008, the Gladding Fire burned 960 acres, six residences, and ten outbuildings northeast of Lincoln. Following is a list of historical wildfires that have occurred around the city dating back to 1975. **Figure 5** shows the areas burned by historical wildfires in and around Lincoln.



Source: ESRI, 2020; California Department of Forestry and Fire Protection, 2019.

Figure 5
Wildfire History

1975/1977 Sawmill Fire. The Sawmill Fire and another fire occurred in the area of Cape Horn and the Alpine Meadows subdivision, just three miles northeast of Colfax.

1990 Placer County Fire. This fire burned approximately 300 acres of grass, brush, and oaks in the area of Placer Canyon. The fire resulted in evacuations and destroyed several outbuildings.

2000 Heather Glen Fire. The Heather Glen Fire, caused by sparks from a lost trailer wheel along Interstate 80 (I-80), destroyed one home and forced a neighborhood evacuation in Applegate. While only 10 acres in size, this fire resulted in $350,000 in damage.

2001 Narrow Gauge Fire. This fire near Colfax burned 30 acres and forced closure of I-80 for about an hour due to dense smoke. This fire, blamed on a catalytic converter, was quickly contained because California Department of Forestry air tankers were already in the area.

2002 Sierra Fire. In the communities of Loomis and Granite Bay, approximately 595 acres of grass, brush, and oaks burned in the area of I-80, Barton Road, Wells Avenue, Morgan Place, Indian Springs, and Cavitt-Stallman Road. The fire destroyed six structures and threatened two schools.

September 2006 Ralston Fire. The Ralston Fire was a large wildfire in the area of the North Fork of the Middle Fork of the American River. Although approximately 8,400 acres burned, there was no record of major property damage.

June/July 2008 American River Complex Fire. Several large wildfires resulted from a system of major lightning storms that impacted the entire Northern California region. In Placer County, approximately 10 wildfires resulted from the lightning storm, and 4 grew to major fires, which later were collectively labeled the American River Complex (ARC) fires. The ARC fires were in Tahoe National Forest in the North Fork American River watershed northeast of Foresthill, California. The fires consumed approximately 20,500 acres of forest land.

September 2008 Gladding Fire. The wind-driven fire started northeast of Lincoln and consumed approximately 960 acres, six residences, and ten outbuildings.

September 2009 49 Fire. The wind driven fire started near Highway 49 and Rock Creek Road near Auburn. The fire was in a well-developed area and spread very quickly, burning 343 acres before being contained. The fire destroyed 63 residences and 3 commercial buildings and severely damaged 3 residences and 6 commercial properties. The damages were concentrated in neighborhoods east and south of Dry Creek Road. Three people were injured in the wildfire.

2012 Robbers Fire. The Robbers Fire was a human-caused fire that was ignited on July 11, 2012. The fire was located northwest of Foresthill, near Shirttail Canyon Road and Yankee Jims Road. The fire burned 2,650 acres, destroyed one residence and four outbuildings, and caused 12 injuries. The firefighting efforts engaged 912 fire personnel. A 28-year-old Sacramento man was charged with unlawfully causing a fire. The estimated firefighting costs and damages were $12.4 million.

2013 American Fire. On August 10, 2013, the American Fire was ignited near Deadwood Ridge, northeast of Foresthill. Located in Tahoe National Forest, the American Fire burned in steep and hazardous terrain as well as timber fuels that had not burned in several decades. Consumption of heavy fuels contributed to heavy smoke in the surrounding areas. Approximately 540 Forest Service and CAL FIRE personnel were assigned to the fire, which burned 27,440 acres.

2014 King Fire. Hazard Mitigation Planning Committee representatives from the Placer Hills and Foresthill Fire Protection Districts noted damaging wildfires in the Foresthill and Applegate areas during the winter of 2014. Specific information on this can be found in their respective annexes to this plan. The fire started in El Dorado County and crossed into Placer County. An estimated 97,717 acres burned, and 12 residences and 68 other minor structures were destroyed. The fire resulted in 12 injuries.

2014 Applegate Fire. This fire occurred on the east side of I-80 in the Applegate area of Placer County. The fire started on October 8, 2014, and its cause was unknown. The fire burned 459 acres before containment. Six residences and four outbuildings were destroyed. Two injuries were reported; however, no deaths were reported.

Potential Changes to Fire Risk in Future Years

Likelihood of Future Occurrence

Highly Likely—The wildfire season in the Sierra foothills typically lasts mid-June through early-October. Extreme weather conditions during periods of low humidity, low fuel moisture, and high winds also contribute to the severity of any potential wildfires. Fires occurring during these times typically burn hot and fast and are difficult to control unless initial suppression occurs immediately. Lincoln has a significant amount of dry range grass that is susceptible to wildfires that can move quickly if accompanied by a stiff breeze. In addition, there is a great potential for wildfires in the more open hillside areas in the eastern part of the city.

Climate Change and Wildfire

Changing climate conditions are expected to increase the wildfire risk in and around Lincoln. Warmer temperatures brought on by climate change can exacerbate drought conditions. Droughts can kill or dry out plants, creating more fuel for wildfires. Warmer temperatures are also expected to increase the number of pest outbreaks, such as the western pine beetle, creating more dead trees and increasing the fuel load. Due to warmer temperatures, the fire season is also likely to begin earlier in the year and extend later than it has historically.

Fire Protection

Fire protection in the planning area is provided by the City of Lincoln and the California Department of Forestry and Fire Protection (CAL FIRE). The City serves the area within the city limits, and CAL FIRE serves the remainder of the Lincoln Planning Area. To reduce the risk of life and property loss to the citizens of Lincoln resulting from urban and wildland fires, the Lincoln Fire Department has implemented several programs, including public education, fire prevention training and information, and fire suppression training. CAL FIRE serves the remainder of the Lincoln Planning Area. Service is provided from the CAL FIRE station approximately two miles east of Lincoln, south of SR 193 at the County property (former missile site).

The Lincoln Fire Department provides fire protection, emergency medical services, and disaster preparedness and response. Lincoln has three fire stations:

- Fire Station No. 33, 17 McBean Park Drive
- Fire Station No. 34, 126 Joiner Parkway
- Fire Station No. 35, 2525 E. Joiner Parkway

8.2.6 Emergency Response

Emergency Preparedness

Emergency preparedness activities in Lincoln are conducted through Lincoln Fire Department. The fire department is prepared to handle most everyday emergencies, such as all types of fire, medical, or hazardous situations. However, during a disaster, the number and scope of incidents likely far exceed the fire department's ability to provide effective emergency services. For this reason, the fire department provides the public with access to a community emergency response team (CERT) training program. CERT provides the following services: Firefighter "rehab," school and fire station visits, utility safety standbys, search and rescue, and any needed activity that would release fire fighters for active duty status.

The City of Lincoln also participates in the Placer County Alert Network, which operates an emergency notification system that allows public safety agencies to help protect lives and property by providing critical information to residents during emergencies and dangerous situations. The Placer County Alert Network is managed by the Placer County Sheriff's Office and allows public safety agencies to quickly send an emergency alert to citizens in any affected geographic area within Placer, Sacramento, and Yolo counties. This system enables the Placer County Sheriff's Office Team to provide residents with critical information quickly in a variety of situations, such as severe weather, unexpected road closures, missing persons, and evacuations of buildings or neighborhoods. Placer Alert provides community members with emergency notifications through telephone call, text message, and email notifications.

Large-scale evacuation events, such as an evacuation of multiple neighborhoods or the entire community, can place significant strain on the City's road network and traffic control systems. Neighborhoods that require large numbers of people to exit through a single roadway may experience congestion and other traffic issues, potentially slowing the rate of evacuating and increasing the risk of harm. In these instances, providing effective traffic control and timely notifications is critical to avoiding evacuation challenges. **Figure 6** shows the roadways and residential parcels in Lincoln that may face difficulty during a large-scale evacuation event due to limited access routes.

The City of Lincoln has an Emergency Response Plan, which was adopted in October 1983. The goal of the plan is to help save lives and minimize property damage through prior planning and emergency preparedness training in the event of a major disaster, such as an earthquake, major fire, flooding, or terrorist situation. The plan is an extension of both the County and State emergency plans, and it establishes an emergency government organization, assigns tasks, provides guidance, and specifies policies and general procedures for the integration and coordination of the planning efforts or various emergency staff and service elements. When the County and State periodically amend their emergency response plans to respond to changing needs and conditions, the City adopts the same amendments to its plan.

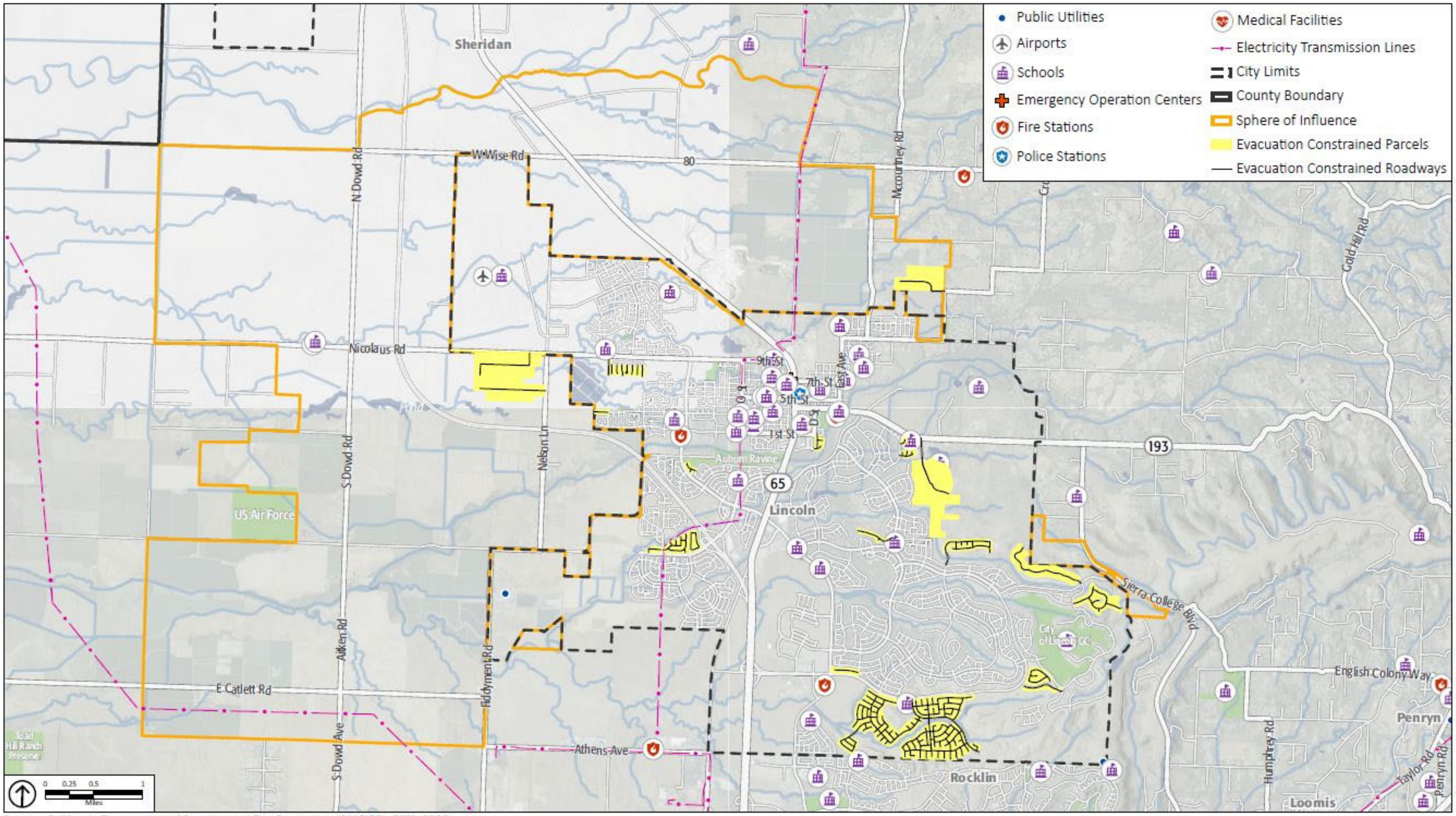
The City also takes proactive measures regarding threats such as wildfire. The fire department manages the Del Webb and Twelve Bridges Wildfire Management Plans. These plans are designed to allow open space while providing control to the threat of wildfire and safety to nearby residents. The open space reduces the threat of wildfire with grazing, firebreaks between property areas, and fire-resistant vegetation. The fire department is responsible for the enforcement of the fire prevention hazard mitigation measures in the reports. Under the City’s weed abatement program, the City annually surveys the open space and oversees the necessary modifications to ensure plan compliance.

Mutual Aid Agreements

Additional emergency management and response services in Lincoln are provided through a mutual aid agreement with the Placer County Fire Department and CAL FIRE. The Placer County Fire Department and CAL FIRE provide a variety of public safety services, including fire protection, medical aid, rescue, hazardous materials response, and educational safety programs. Other services consist of fire code enforcement and regulation, plan reviews, home and business inspections, and fire code permits.

PLACEWORKS

CITY OF LINCOLN SAFETY ELEMENT UPDATE
CITY OF LINCOLN
SAFETY ELEMENT



Source: California Department of Forestry and Fire Protection (CALFIRE); ESRI, 2020.

Figure 6
Evacuation Constrained Parcels and Roadways

8.2.7 Climate Change

Changes to the global climate system are expected to affect future occurrences of natural hazards in and around Lincoln. Many hazards are projected to become more frequent and more intense in coming years and decades, and in some cases, these trends have already begun. According to State's *Fourth Climate Change Assessment*[1] and associated reports and the *Placer County Sustainability Plan*,[2] Lincoln can expect the following changes to natural hazard events:

- Both droughts and floods are expected to become more frequent as periods of very high and very low precipitation become more common. Warmer temperatures are expected to increase melting of snow in the Sierra during spring, which may also contribute to greater flooding at that time of year. This may also make less water available later in the year, increasing the risk of drought potential in the late summer and autumn.
- Warmer temperatures are projected to cause an increase in extreme heat events, which for Lincoln is any day where the high temperature exceeds 105°F. Historically, extreme heat days occur on average four times a year. By 2050, such events may occur 22 to 30 times each year on average, and may occur more than 50 times annually by the end of the century.
- The area around Lincoln is expected to see an increase in wildfires due to hotter, drier weather. Although the risk is greatest in the forested areas of the Sierra Nevada and local foothills, Lincoln may still experience an increase in local wildfire activity. More frequent regional wildfires may also create poor air quality in Lincoln even if the community itself is not damaged by fire.
- Severe weather events, such as strong storms and high winds, may become more frequent and more intense due to climate change. Heavy rainfall may also contribute to an increased risk of landslides in the hills around Lincoln.
- Pests and diseases may be active for longer periods of time due to warmer temperatures. Changes in temperature and precipitation patterns may cause pests and diseases that have historically not been present in Lincoln to be more permanent in the community. This includes pests and diseases that are a threat to human health as well as those that may affect agricultural crops, livestock, and local wild ecosystems.

[1] Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission). 2018. *Statewide Summary Report. California's Fourth Climate Change Assessment.* Publication number: SUMCCCA4-2018-013.

[2] County of Placer. 2020. *Placer County Sustainability Plan.* Adopted January 28, 2020: Resolution 2020-019. Prepared by: Placer County Community Development and Resource Agency, PlaceWorks, Sierra Business Council, Fehr & Peers.

Under California law, the safety element is required to include a vulnerability assessment that looks at how people, buildings, infrastructure, and other key community assets may be affected by climate change. The City conducted a vulnerability assessment in the spring of 2020, which built off of the 2018 vulnerability assessment prepared for the *Placer County Sustainability Plan*, to analyze Lincoln's susceptibility to climate-related hazards. The City of Lincoln's vulnerability assessment, prepared in accordance with the most recent available guidance in the *California Adaptation Planning Guide*, assesses how eight different climate-related hazards (agricultural pests and diseases, drought, extreme heat, flooding, human health hazards, landslides, severe weather, and wildfire) may affect 51 different population groups and community assets. Each population or asset received a score of V1 (minimal vulnerability) to V5 (severe vulnerability) for each climate-related hazard. Some of the key results of the vulnerability assessment are:

- Persons who are already among the most vulnerable in society are expected to face the greatest hardship from climate-related hazards. This includes children under 10 years of age, persons in poverty, persons experiencing homelessness, and senior citizens, especially senior citizens living alone.
- Bridges and electrical transmission lines are the most vulnerable infrastructure systems. Bridges are highly vulnerable to flooding and severe weather, and electrical lines are most susceptible to extreme heat, severe weather, and wildfire.
- Private homes, community facilities, and local parks face a higher risk from climate-related hazards than most other buildings, especially from severe weather and wildfire. Although wildfires are not very common in Lincoln proper, they have the potential to be most damaging to local buildings, especially as fires become more frequent.
- While all sectors of the local economy can be disrupted by climate-related hazards, local agricultural operations may be the most vulnerable. Many different climate-related hazards could cause widespread and severe harm to agriculture in and around Lincoln.
- Local wetlands and vernal pools may be threatened by increases in drought, while grasslands around Lincoln face substantial harm from more frequent wildfire events.
- Among the key community services in Lincoln, energy service, communication service, and emergency medical response have the potential to face the more significant disruptions from climate-related hazards.

Appendix A shows the full results of the vulnerability assessment for Lincoln.

8.2.8 Noise

In technical terms, sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Simply, sound is what we hear. As sounds reach undesirable unacceptable levels, this is referred to as noise.

To develop goals and policies related to noise abatement in the updated General Plan, it is important to understand how sound, and noise, are measured and compared and to understand what sound levels occur in the county today. To do this, this section:

- Describes key terms;
- Provides an overview of how noise is characterized (measured);
- Describes existing regulations that affect noise issues; and
- Discusses current noise conditions found through out the City's Planning Area.

Methods

The methods used to assess noise are described throughout this section. A summary of noise standards was provided based on a review of all applicable federal, State, and local noise regulations. Estimates of traffic noise were provided using recent average daily traffic volumes collected for the "Transportation" section of this Background Report. Existing and future airport noise contours were provided from the City's existing Lincoln Regional Airport Master Plan. A discussion of other noise sources was based on noise measurements collected by Environmental Science Associates technical staff.

Key Terms

Ambient Noise. The total noise associated with a given environment and usually comprising sounds from many sources, both near and far.

Attenuation. Reduction in the level of sound resulting from absorption by the topography, the atmosphere, distance, barriers, and other factors.

A-weighted decibel (dBA). A unit of measurement for noise having a logarithmic scale and measured using the A-weighted sensory network on a noise-measuring device. An increase or decrease of 10 decibels corresponds to a tenfold increase or decrease in sound energy. A doubling or halving of sound energy corresponds to a 3-dBA increase or decrease.

Community Noise Equivalent Level (CNEL). Used to characterize average sound levels over a 24-hour period, with weighting factors included for evening and nighttime sound levels. L_{eq} values (equivalent sound levels measured over a 1-hour period - see below) for the evening period (7:00 p.m. to 10:00 p.m.) are increased by 5 dB, while L_{eq} values for the nighttime period (10:00 p.m. to 7:00 a.m.) are increased by 10 dB. For a given set of sound measurements, the CNEL value will usually be about 1 dB higher than the L_{dn} value (average sound exposure over a 24-hour period – see below). In practice, CNEL and L_{dn} are often used interchangeably.

Day-Night Average Sound Level (L_{dn}). Average sound exposure over a 24-hour period. L_{dn} values are calculated from hourly L_{eq} values, with the L_{eq} values for the nighttime period (10:00 p.m. to 7:00 a.m.) increased by 10 dB to reflect the greater disturbance potential from nighttime noises.

Equivalent Sound Level (L_{eq}). The level of a steady-state sound that, in a stated time period and at a stated location, has the same sound energy as the time-varying sound (approximately equal to the average sound level). The equivalent sound level measured over a 1-hour period is called the hourly L_{eq} or L_{eq} (h).

L_{max} and L_{min}. The maximum and minimum sound levels, respectively, measured during the measurement period. When a sound meter is set to the "slow" response setting, as is typical for most community noise measurements, the L_{max} and L_{min} values are the maximum and minimum levels measured over a 1-second period.

Percentile-Exceeded Sound Level (L_x). The sound level exceeded during a given percentage of a measurement period. Examples include L_{10}, L_{50}, and L_{90}. L_{10} is the A-weighted sound level that is exceeded 10% of the measurement period, L_{50} is the level exceeded 50% of the period, and so on. L_{50} is the median sound level measured during the measurement period. L_{90}, the sound level exceeded 90% of the time, excludes high localized sound levels produced by nearby sources such as single car passages or bird chirps. L_{90} is often used to represent the background sound level. L_{50} is also used to provide a less conservative assessment of the background sound level.

Sensitive Receptors. Sensitive receptors are defined to include residential areas, hospitals, convalescent homes and facilities, schools, and other similar land uses.

Regulatory Setting

Noise issues are subject to various federal, State and local regulations. This section begins with a brief introduction to the characteristics of sound and follows with a brief overview of key regulations.

Characteristics of Sound

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise can be defined as unwanted sound. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude) of a particular sound. The sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. The decibel (dB) scale is used to quantify sound intensity. Because sound pressure can vary by over one trillion times within the range of human hearing, a logarithmic loudness scale (i.e., dB scale) is used to keep sound intensity numbers at a convenient and manageable level.

Since the human ear is not equally sensitive to all frequencies within the entire spectrum, noise measurements are weighted more heavily within those frequencies of maximum human sensitivity in a process called "Aweighting" written as dBA. The human ear can detect changes in sound levels of approximately 3 dBA under normal conditions. Changes of 1 to 3 dBA are typically noticeable under controlled conditions, while changes of less than 1 dBA are only discernable under controlled, extremely quiet conditions. A change of 5 dBA is typically noticeable to the general public in an outdoor environment. **Table 7** summarizes typical A-weighted sound levels.

Table 7. Typical Noise Level

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock Band
Jet Fly-Over at 300 meters (1000 feet)		
	— 100 —	
Gas Lawn Mower at 1 meter (3 feet)		
	— 90 —	
		Food Blender at 1 meter (3 feet)
Diesel Truck at 15 meters (50 feet)		
at 80 kilometers/hour (50 miles/hour)	— 80 —	Garbage Disposal at 1 meter (3 feet)
Noisy Urban Area, Daytime		
Gas Lawn Mower, 30 meters (100 feet)	— 70 —	Vacuum Cleaner at 3 meters (10 feet)
Commercial Area		Normal Speech at 1 meter (3 feet)
Heavy Traffic at 90 meters (300 feet)	— 60 —	
		Large Business Office
Quiet Urban Daytime	— 50 —	Dishwasher Next Room
Quiet Urban Nighttime	— 40 —	Theater, Large Conference
Quiet Suburban Nighttime		Room (Background)
	— 30 —	Library
Quiet Rural Nighttime		Bedroom at Night, Concert
	— 20 —	
		Broadcast/Recording Studio
	— 10 —	
Lowest Threshold of Human Hearing	— 0—	Lowest Threshold of Human Hearing

Source: *California Department of Transportation, 1998a*

Environment noise fluctuates over time. While some noise fluctuations are minor, others can be substantial. Some noise levels occur in regular patterns, others are random. Some noise levels fluctuate rapidly, others slowly. Some noise levels vary widely, others are relatively constant. Various noise descriptors have been developed to describe time-varying noise levels, and are listed under the "Key Terms" section.

Calculating Attenuation

Noise may be generated from a point source, such as a piece of construction equipment, or from a line source, such as a road containing moving vehicles. Because of spreading losses, noise attenuates (decreases) with distance. The typical atmospheric attenuation rate for point source noise is 6 dBA per doubling of the distance as predicted by the equation:

dBA Reduction = 20 Log [measured distance]
(Lower bracket to include both reference distance *quantities)*

Noise from a line source will also attenuate with distance, but the rate of attenuation is a function of both distance and the type of terrain over which the noise passes. Hard sites, such as developed areas with paving, attenuate noise at a rate of 3 dBA per doubling of the distance as predicted by the equation:

dBA Reduction = 10 Log [measured distance]
reference distance

Soft sites, such as undeveloped areas, open space, and vegetated areas attenuate line-source noise at a rate of 4.5 dBA per doubling of the distance, as predicted by the equation:

Attenuated dBA = 15 Log [measured distance]
reference distance

True hard sites are fairly rare, particularly in rural areas. Accordingly, soft site attenuation is typically assumed for planning level analyses in rural areas.

Objects such as walls, topography, and buildings which block the line-of sight between a source and a receptor will attenuate the noise source. If a receptor is located behind the object, but has a view of the source, the wall will do little to attenuate the noise. Additionally, a receptor located on the same side of the object as the noise source may experience an increase in the perceived noise level as the object may reflect noise back to the receptor, possibly increasing the noise.

Noise Contours

The interpretation of noise contours is a generalization, not an exact science. The measurements by sophisticated instruments are affected by many variables in a particular area. However, these individual effects are generalized so that noise contours describe the impact that can generally be expected. Noise contour lines themselves are not specific boundaries of noise tolerance. A contour line denoting a 65 dBA limit, for example, does not imply that residents on one side of the line are seriously affected, while on the other side of the line tolerable conditions exist. Rather, the area between 75 dBA and 65 dBA indicates that residents within this vicinity may experience a high level of noise and potential interference with daily functions.

Effects of Noise

High noise levels can interfere with a broad range of human activities in a way which degrades public health and welfare. Such activities may include:

- Speech communication in conversation and teaching;
- Telephone communication;
- Listening to television and radio;
- Listening to music;
- Concentration during mental and physical activities;
- Relaxation; and
- Sleep.

Interference with listening situations can be determined in terms of the level of the environmental noise and its characteristics. The amount of interference in non-listening situations is often dependent upon factors other than the physical characteristics of the noise. These may include attitude toward the source of an identifiable noise, familiarity with the noise, characteristics of the exposed individual, and the intrusiveness of the noise.

Hearing loss, total or partial, and either permanent or temporary, is a well-established effect of noise on human health. The primary measure of hearing loss is the hearing threshold level - the level of a tone that can just be detected by an individual. As a person is exposed to increased noise levels, that person may experience a shift in the threshold at which sound can be detected. Exposure to very high noise levels for lengthy periods of time can generate threshold shifts, which can be temporary or permanent. In general, A-weighted sound levels must exceed 60-80 decibels before a person will experience temporary threshold shifts. The greater the intensity level above 60-80 decibels and the longer the exposure, the greater length of the temporary threshold shift.

Federal Regulations

Federal Highway Administration (FHWA). The FHWA has developed noise abatement criteria that are used for federally funded roadway projects or projects that require federal review. These criteria are discussed in detail in Title 23 Part 772 of the Federal Code of Regulations (23CFR772). These noise criteria are based on Leq (h) and are summarized in **Table 8**.

Environmental Protection Agency. The EPA has identified the relationship between noise levels and human response. The EPA has determined that over a 24-hour period, an L_{eq} of 70 dBA will result in some hearing loss. Interference with activity and annoyance will not occur if exterior levels are maintained at an L_{eq} of 55 dBA and interior levels at or below 45 dBA. Although these levels are relevant for planning and design and useful for informational purposes, they are not land use planning criteria because they do not consider economic cost, technical feasibility, or the needs of the community.

Table 8. Noise Abatement Criteria

Activity Category	Design Noise	Description of Activity Category
	Leq (h) (dBA)	
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas
C	72 (exterior)	Developed lands
D	---	Undeveloped lands
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: *Federal Highway Administration, 1982.*

The EPA has set 55 dBA L_{dn} as the basic goal for residential environments. However, other federal agencies, in consideration of their own program requirements and goals, as well as difficulty of actually achieving a goal of 55 dBA L_{dn}, have generally agreed on the 65 dBA L_{dn} level as being appropriate for residential uses. At 65 dBA L_{dn} activity interference is kept to a minimum, and annoyance levels are still low. It is also a level that can realistically be achieved.

Department of Housing and Urban Development (HUD). HUD was established in response to the Urban Development Act of 1965 (Public Law 90-448). HUD was tasked by the Housing and Urban Development Act of 1965 (Public Law 89-117) "to determine feasible methods of reducing the economic loss and hardships suffered by homeowners as a result of the depreciation in the value of their properties following the construction of airports in the vicinity of their homes."

HUD first issued formal requirements related specifically to noise in 1971 (HUD Circular 1390.2). These requirements contained standards for exterior noise levels along with policies for approving HUD-supported or assisted housing projects in high noise areas. In general, these requirements established the following three zones:

- 65 dBA L_{dn} or less - an *acceptable zone* where all projects could be approved.
- Exceeding 65 dBA Ldn but not exceeding 75 dBA Ldn - a normally unacceptable zone where mitigation measures would be required and each project would have to be individually evaluated for approval or denial. These measures must provide 5 dBA of attenuation above the attenuation provided by standard construction required in a 65 to 70 dBA Ldn area and 10 dBA of attenuation in a 70 to 75 dBA Ldn area.
- Exceeding 75 dBA Ldn - an unacceptable zone in which projects would not, as a rule, be approved.

HUD's regulations do not include interior noise standards. Rather a *goal* of 45 dBA L_{dn} is set forth and attenuation requirements are geared towards achieving that goal. HUD assumes that using standard construction techniques, any building will provide sufficient attenuation so that if the exterior level is 65 dBA L_{dn} or less, the interior level will be 45 dBA L_{dn} or less.

Thus, structural attenuation is assumed at 20 dBA. However, HUD regulations were promulgated solely for residential development requiring government funding and are *not* related to the operation of schools or churches.

The federal government regulates occupational noise exposure common in the workplace through the Occupational Health and Safety Administration (OSHA) under the EPA. Noise exposure of this type is dependent on work conditions and is addressed through a facility's or construction contractor's health and safety plan. With the exception of construction workers involved in facility construction, occupational noise is irrelevant to this study and is not addressed further in this document.

State Regulations

California Department of Transportation (Caltrans). Caltrans has adopted policy and guidelines relating to traffic noise as outlined in the Traffic Noise Analysis Protocol (Caltrans 1998b). The noise abatement criteria specified in the protocol are the same as those specified by FHWA.

Governor's Office of Planning and Research (OPR). OPR has developed guidelines for the preparation of general plans (Office of Planning and Research, 1998). The guidelines include land use compatibility guidelines for noise exposure.

Local Regulations

The California Department of Health Services (DHS) Office of Noise Control has studied the correlation of noise levels and their effects on various land uses. Land use and noise compatibility criteria for the City have been developed from the California Office of Noise Control Land Use Compatibility Matrix for Community Noise Exposure. Maximum acceptable noise levels for various land uses are shown in **Table 9**.

Table 9. Maximum Acceptable Ambient Noise Exposure for Various Land Uses in the City of Lincoln

Land Use	Suggested Maximum Ldn
Residential – low density	60
Residential – high density	65
Transient lodging	65
Schools, libraries, churches, hospitals	65
Playgrounds, parks	65
Commercial	70
Industrial	75

As shown in the table, low-density residential are most sensitive to noise intrusion, with noise levels of 60 dBA CNEL and below considered "acceptable". For schools, libraries, churches, hospitals, and parks, acceptable noise levels are as high as 65 dBA CNEL. Acceptable noise levels for commercial and industrial land uses go up to 70 and 75 dBA CNEL, respectively.

In addition to noise producers, the other major factor in assessing current noise conditions is an assessment of sensitive receptors in the City's Planning Area. That is, the impact of a noise from vehicles or a facility depends on who is exposed to the noise. Typically, sensitive receptors are defined to include residential areas, hospitals, convalescent homes and facilities, schools, and other similar land uses.

Environmental Setting

The primary noise generators within the City's Planning Area consist of vehicular traffic along SR 65, other local roadways, the Lincoln Regional Airport, and the Union Pacific Railroad line. Each of these noise sources is described in greater detail below.

Traffic Noise

Roadway and traffic noise are the dominant source of ambient noise in the City. The major source of vehicular traffic noise within the City's Planning Area is SR 65 and 193, with the most significant noise levels occurring within the existing Central Business District.

The noise generated from vehicles using roads within the Planning Area is governed primarily by the number of vehicles, type of vehicles (mix of automobiles, trucks, and other large vehicles), and speed. Sound32 is Caltrans' computer implementation of the FHWA Traffic Noise Prediction Model (FHWA-RD-77-108). Sound32 and traffic information provided in Section 5 "Transportation and Circulation" of this report were used to develop baseline traffic noise contours for major roads in the Planning Area. **Table 10** summarizes the daily traffic volumes, the predicted Ldn noise level at 100 feet from the roadway centerline, and the distance from the roadway centerline to the 60-, 65-, and 70- dB-Ldn contours. The contour levels correspond to the land use compatibility levels specified in **Table 11**. Because these calculated contours do not take into account shielding caused by local buildings, walls, or topographical features, the distances should be considered to be worst-case estimates of noise exposure along roadways in the Planning Area.

Table 10. Traffic Noise Levels Along Roadways in the Planning Area

Roadway/Segment	Daily Traffic Volume	Ldn @ 100 feet	Distance (feet) to 70 Ldn Contour from Roadway Centerline	Distance (feet) to 65 Ldn Contour from Roadway Centerline	Distance (feet) to 60 Ldn Contour from Roadway Centerline
State Route 65					
Sterling Parkway / Ferrari Ranch Road	28,000	70	100	215	1,000
Ferrari Ranch Road / First Street	23,000	69	86	185	858
First Street / SR 193	18,000	64	40	86	398
7th Street / Gladding Road	16,700	63	34	74	341

Table 11. Community Noise Exposure L_{dn} or CNEL, Db

Land Use Category	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential – Low Density, Single Family, Duplex, Mobile Homes	50-60	55-70	70-75	75-85
Residential – Multi Family	50-65	60-70	70-75	75-85
Transient Lodging – Motels, Hotels	50-65	60-70	70-80	80-85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-70	60-70	70-80	80-85
Auditoriums, Concert Halls, Amphitheaters		50-70		65-85
Sports Arena, Outdoor Spectator Sports		50-75		70-85
Playgrounds, Neighborhood Parks	50-70	N/A	67-75	72-85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-75	N/A	70-8	80-85
Office Buildings, Business Commercial and Professional	50-70	67-77	75-85	N/A
Industrial, Manufacturing Utilities, Agriculture	50-75	70-80	75-85	N/A

Interpretation

Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable – New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Normally Unacceptable – New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable – New construction or development should generally not be undertaken.

Railroad Operations Noise

Railroad noise within the City results from operations along the UPRR, which bisects the existing Planning Area along the west side of SR 65. Several factors combine to produce railroad noises, including length of train, speed, grade, type of track, number of engines, number of at-grade crossings which require horns to be used, and number of trips. Noise contours for the UPRR are provided in **Figure 6**. In developing the noise contours, two long-term (24-hour) sound measurements were collected. The Ldn from the 24-hour measurements (located south of 1st Street) were estimated to be 84 dBA at 35 feet from the center of the railroad. This measurement was used to develop railroad noise contours for the UPRR from this location because the location appeared to be representative of a typical railroad noise source without interference from sound reflection. Widely distributed noises, such as a street with moving vehicles or a railroad (a “line” source), will typically attenuate (lessen) at a rate of 3 to 4.5 dBA per doubling distance from the source, depending on existing environmental conditions (i.e., atmospheric conditions and noise barriers, either vegetative or manufactured, etc.) (Caltrans 1998).

Using the above mentioned reference data, noise level contours were estimated from the center line of the railroad. As shown in **Figure 7**, at 88 feet from the railroad center line, the noise level would be approximately 80 dBA. At 275 feet from the railroad center line, the noise level would be approximately 75 dBA. At 900 feet from the railroad center line, the noise level would be approximately 70 dBA. It should be noted that these noise levels do not take into account potential shielding from existing buildings, which could increase the rate of attenuation over a given distance.

Airport Noise

Land located within the Airport's compatibility Zones will be subject to the noise standards set forth in Table 2B in the Airport Land Use Compatibility Plan.

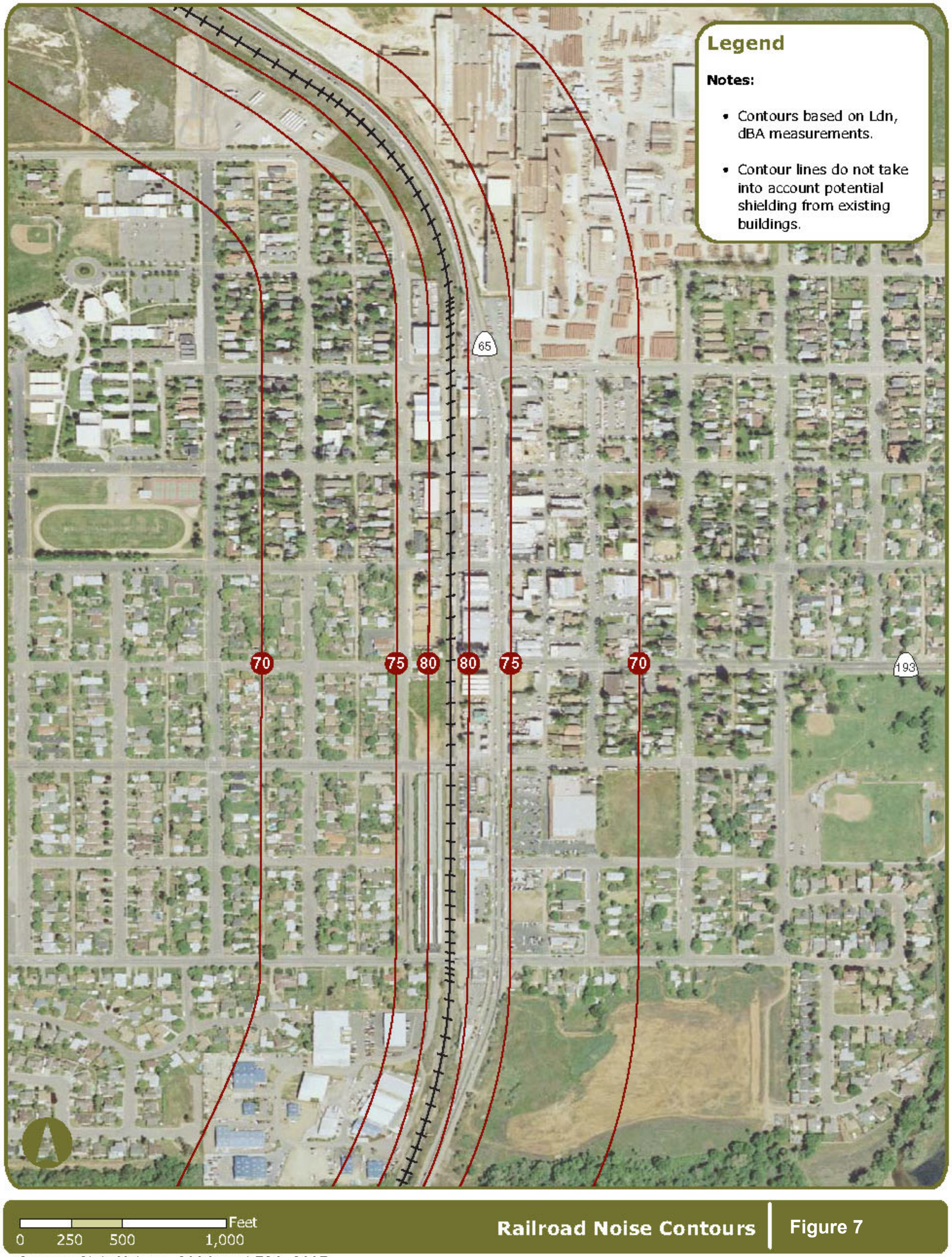
Aircraft noise affecting the City is produced by operations at the existing Lincoln Regional Airport. The greatest potential for noise intrusion occurs when aircraft land, take off, or run their engines while on the ground. There are three primary sources of noise in a jet engine: the exhaust, the turbomachinery, and the fan. The noise associated with general aviation propeller aircraft (piston and turbo-prop) is produced primarily by the propellers and secondarily from the engine and exhaust.

Airport noise contours for both a base year (2003) and a future year (2033) were prepared as part of the 2004 Lincoln Regional Airport Master Plan. These contours are identified in Figures 8 and 9. Currently (**Figure 8**), all of the 65 CNEL contour and a majority of the 60 CNEL contour fall within the existing airport property boundary. The 60 CNEL contour extends beyond the airport boundary to the northwest and to the south, along the extended runway center line. Approximately 17 acres of land (outside the ownership of the airport) fall within the 60 CNEL contour.

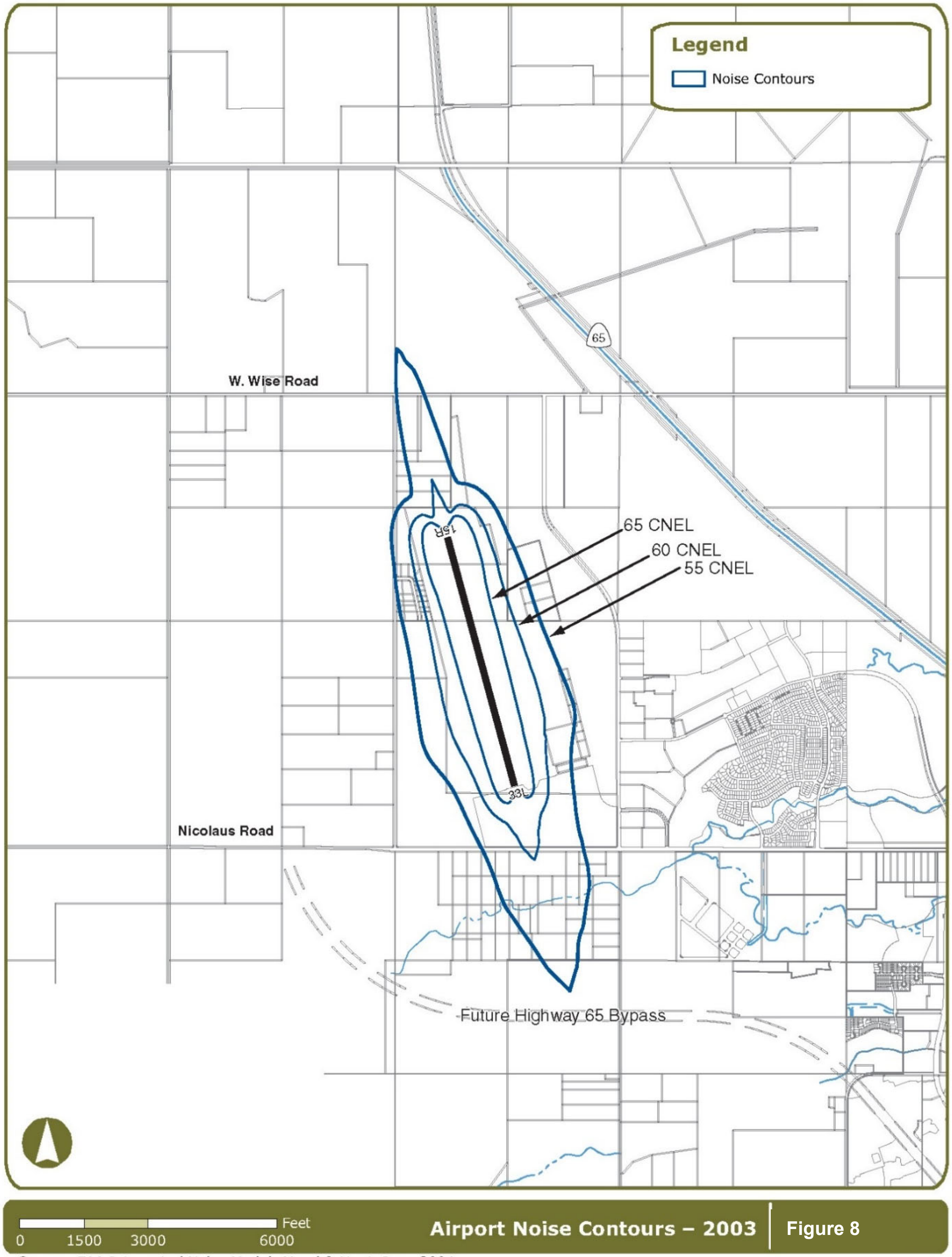
Figure 9 identifies projected or future airport noise contours. As shown in the figure, over 30% of the 60 CNEL extends beyond the airport's property to the north and south. This would affect an estimated 300 acres of land within these areas. To a lesser extent, the 65 CNEL contour also extends beyond the airport's boundary and is estimated to affect approximately 44 acres of land. Future airport noise contours are based on a projected increase of nearly 106,000 annual operations at the Lincoln Regional Airport by the year 2033.

Existing Noise Levels within the City of Lincoln

A community noise survey was conducted in January 2003 at 8 locations throughout the Planning Area to characterize typical noise levels. Instrumentation used for obtaining the measurements was a Metrosonics Model db-308 precision integrating sound level meter, which was calibrated in the field before use with a Metrosonics CL-304 acoustical calibrator.

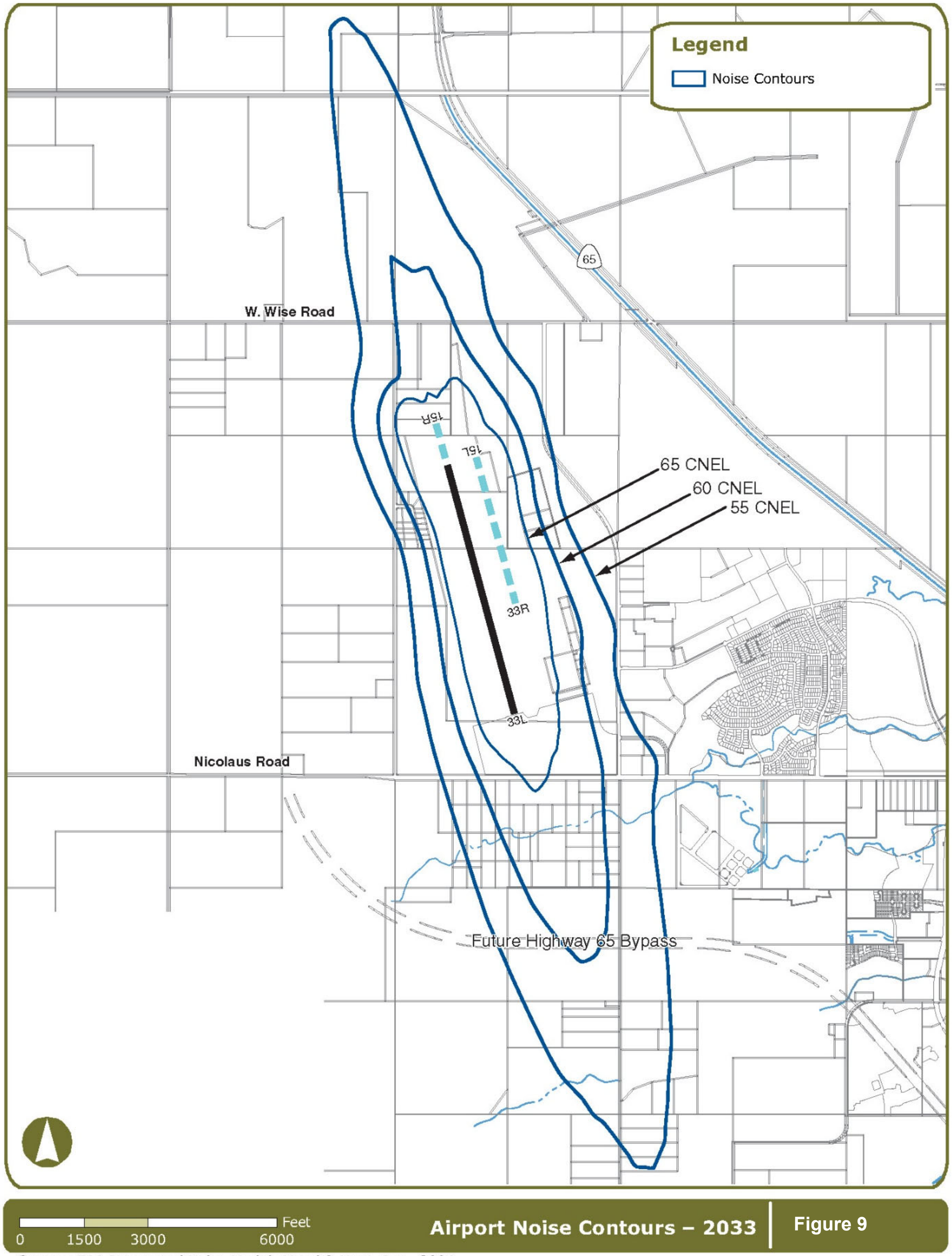


Source: GlobeXplorer, 2004; and ESA, 2005



Airport Noise Contours – 2003 | Figure 8

Source: FAA Integrated Noise Model; Mead & Hunt, Inc., 2004



Airport Noise Contours – 2033 | **Figure 9**

Source: FAA Integrated Noise Model; Mead & Hunt, Inc., 2004

The results of the survey are provided in **Table 12**. Each of the monitoring positions is identified in **Figure 10**. As shown in the table, short-term (approximately 10 minutes) monitoring was conducted at 7 locations in the Planning Area, with one long-term or 24-hour measurement conducted just south of the Lincoln Regional Airport. The results of the noise survey indicate that typical noise levels in the areas measured range from 50 to 73 dBA.

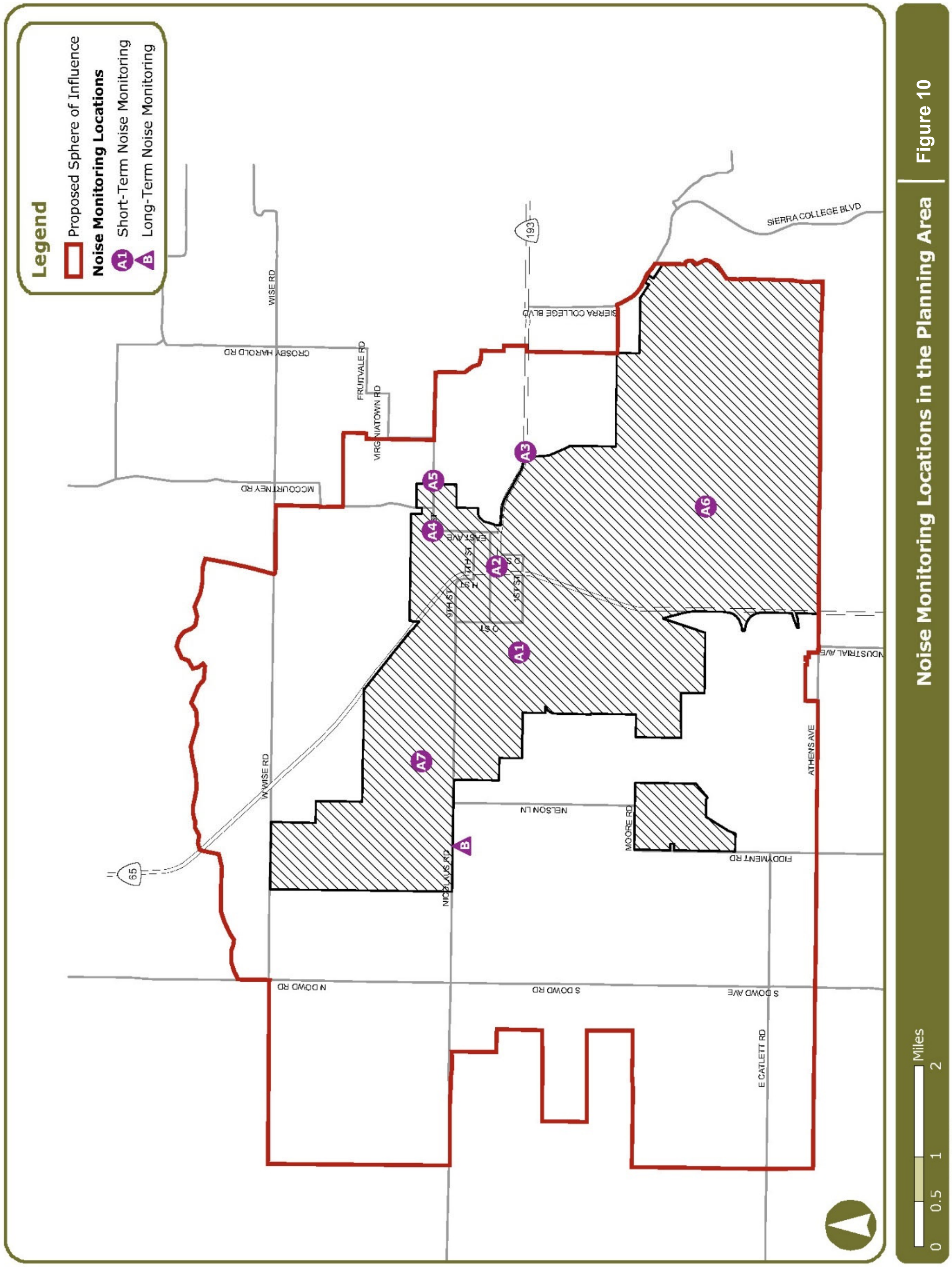
Table 12. Noise Measurement Results within the City of Lincoln Planning Area

Location [A]	Date of Measurement	Start Time	Length of Measurement	Leq [B]	Lmax [C]	L(10) [D]	L(90) [E]
Site (A1) – SE corner of the intersection of 1st and R Streets	1/7/2003	12:01	10-minute	61.0	77.1	63.0	44.6
Site (A2) – SE corner of the intersection of SR 65 and SR 193	1/7/2003	12:20	10-minute	73.8	84.7	77.0	64.0
Site (A3) – SE corner of the intersection of SR 193 and Oak Tree Lane	1/7/2003	12:55	10-minute	66.9	80	71.0	45.0
Site (A4) – SW corner of the intersection of East and 12th Streets	1/7/2003	13:20	10-minute	63.7	77.4	67.0	50.0
Site (A5) – Virginiaton Road	1/7/2003	13:42	10-minute	58.4	75.8	56.0	41.0
Site (A6) – Rose Bouquet Drive (Center of Greenway)	1/7/2003	14:40	10-minute	52.4	72.5	47.0	43.0
Site (A7) – SW corner of the intersection of Floradale Way and Taylor Circle	1/7/2003	16:20	10-minute	53.5	71.1	54.0	41.0
Site (B) – Neighborhood Lane (500 south of Lincoln Airport)	1/8/2003	1:00	24-hour	50.5	87.2[F]	45.0	41.0

NOTE: *All measurements are provided in A-weighted decibels (dBA), unless otherwise noted.*

A. *Locations of each noise measurement are provided in* ***Figure 9****. Measurements were taken at 50 feet or less from the centerline of the corresponding roadway.*
B. Equivalent or energy-averaged sound level.
C. The highest root-mean-square (RMS) sound level measured over a given period of time.
D. The noise level that is equaled or exceeded 10 percent of the specified time period. The L10 is often considered the maximum noise level averaged over the specified time period.
E. The noise level that is equaled or exceeded 90 percent of the specified time period. The L90 is often considered the background noise level averaged over the specified time period.
F. Note: Lpeak = 121.2 (Defined as the highest noise level logged during the sampling period.)

Source: *Environmental Science Associates, 2003*



Noise Monitoring Locations in the Planning Area | Figure 10

Appendix A: Vulnerability Assessment Results

The tables below show the results of the vulnerability assessment prepared for the City of Lincoln, in accordance with the requirements of Senate Bill 379. For each population or asset that may be vulnerable to each climate-related hazard, the population or asset is scored on a scale of 1 to 5:

V1: Minimal vulnerability

V2: Low vulnerability

V3: Moderate vulnerability

V4: High vulnerability

V5: Severe vulnerability

These vulnerability scores are based on an assessment of the severity of climate-related impacts and the ability of Lincoln's populations and assets to resist and recover from these effects. Please refer to the "Climate Change" section of the Health & Safety Element for additional details on the vulnerability assessment method.

Population or Asset	Hazards			
	Agricultural Pests and Diseases	Drought	Extreme Heat	Flooding
Populations				
Children (Under 10)	-	-	V4	V3
Cost-burdened households	-	V3	V3	V3
Households in poverty	-	V4	V4	V5
Immigrants and refugees	V4	-	V4	V3
Outdoor workers	V4	V4	V4	-
Persons experiencing homelessness	-	-	V5	V5
Persons in overcrowded households	-	-	V2	V3
Persons with chronic illnesses	-	-	V4	V3
Persons with disabilities	-	-	V3	V3

Population or Asset	Hazards			
	Agricultural Pests and Diseases	Drought	Extreme Heat	Flooding
Persons with limited English proficiency	-	-	V2	V2
Persons without access to lifelines	-	-	V3	V4
Renters	-	-	V3	V2
Seniors (65+)	-	-	V4	V3
Senior living alone	-	-	V5	V4
Infrastructure				
Airports	-	-	V2	-
Biking Trails	V2	V2	-	V3
Bridges	-	-	-	V5
Communication facilities	-	-	V2	V1
Electrical substations	-	-	V3	-
Electrical transmission lines	V3	-	V4	-
Evacuation routes	V2	-	V2	V4
Flood control infrastructure	-	-	-	V3
Major roads and highways	-	-	V2	V4
Natural gas facilities	-	-	-	V3
Power plants	-	-	V3	-
Rail lines	-	-	V3	V3
Water and wastewater infrastructure	-	V2	V1	V3
Buildings				
Businesses	-	-	V3	V3
Community facilities	-	-	V2	V2
Community and regional parks	V3	V3	V1	V1

Population or Asset	Hazards			
	Agricultural Pests and Diseases	Drought	Extreme Heat	Flooding
Government office	-	-	V2	-
Homes	V2	-	V3	V3
Library	-	-	V1	-
Medical facilities	-	-	V2	-
Public safety buildings	-	-	V2	-
Schools	-	-	V3	-
Thunder Valley Casino	-	-	V1	-
Important Economic Assets				
Farms, orchards, vineyards	V3	V4	V5	V4
Livestock	V3	V4	V5	V2
Rice growing	V3	V5	V3	V4
Outdoor recreation	-	V1	V4	V2
Ecosystems and Natural Resources				
Chaparral	V2	V3	V2	V1
Grasslands	V2	V3	V2	V2
Valley and riparian woodlands	V2	V3	V2	V3
Wetlands	V1	V4	V3	V2
Key Community Services				
Communication services	-	-	V3	V1
Emergency medical response	V2	-	V2	V3
Energy delivery	V4	V2	V4	V1
Freight and Shipping	-	-	V1	V2
Public safety response	V2	-	V2	V3

Population or Asset	Hazards			
	Agricultural Pests and Diseases	Drought	Extreme Heat	Flooding
Water and wastewater	-	V3	V1	V3

Population or Asset	Hazards			
	Human Health Hazards	Landslides	Severe Weather	Wildfire
Populations				
Children (Under 10)	V3	-	-	V3
Cost-burdened households	V3	V3	V3	V3
Households in poverty	V4	V4	V4	V5
Immigrants and refugees	V4	V3	V4	V3
Outdoor workers	V4	-	V3	V4
Persons experiencing homelessness	V5	-	V5	V5
Persons in overcrowded households	V3	-	V3	V3
Persons with chronic illnesses	V4	V2	V4	V3
Persons with disabilities	V3	V3	V3	V3
Persons with limited English proficiency	V3	V2	V3	V2
Persons without access to lifelines	V3	V3	V3	V3
Renters	V2	V2	V2	V2
Seniors (65+)	V3	V3	V3	V4
Senior living alone	V4	V4	V4	V5
Infrastructure				
Airports	-	-	V2	-
Biking Trails	-	V3	V2	V3

Population or Asset	Hazards			
	Human Health Hazards	Landslides	Severe Weather	Wildfire
Bridges	-	-	V4	V2
Communication facilities	-	V2	V2	-
Electrical substations	-	-	V2	V2
Electrical transmission lines	-	-	V4	V4
Evacuation routes	-	V2	V3	V3
Flood control infrastructure	-	V1	V2	V1
Major roads and highways	-	V2	V3	V3
Natural gas facilities	-	-	-	V4
Power plants	-	-	V3	-
Rail lines	-	V2	V3	V2
Water and wastewater infrastructure	-	V3	V2	V3
Buildings				
Businesses	-	V2	V3	V3
Community facilities	-	-	V3	V4
Community and regional parks	-	V3	V2	V4
Government office	-	-	V3	V3
Homes	-	V3	V4	V4
Library	-	-	V3	-
Medical facilities	-	-	V2	-
Public safety buildings	-	-	V3	V3
Schools	-	V2	V3	V3
Thunder Valley Casino	-	V2	V3	V3
Important Economic Assets				

Population or Asset	Hazards			
	Human Health Hazards	Landslides	Severe Weather	Wildfire
Farms, orchards, vineyards	V3	-	V2	V2
Livestock	V4	-	V4	V3
Rice growing	V2	-	V3	V2
Outdoor recreation	V4	-	V3	-
Ecosystems and Natural Resources				
Chaparral	-	-	-	V3
Grasslands	-	-	-	V4
Valley and riparian woodlands	-	-	V2	V1
Wetlands	-	-	-	-
Key Community Services				
Communication services	-	V2	V4	V3
Emergency medical response	V4	V3	V3	V2
Energy delivery	-	V2	V4	V4
Freight and Shipping	V3	V2	V2	V2
Public safety response	V2	V3	V3	V3
Water and wastewater	-	V2	V1	V3